

JUNE 1952

PRICE 35 CENTS

# ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING



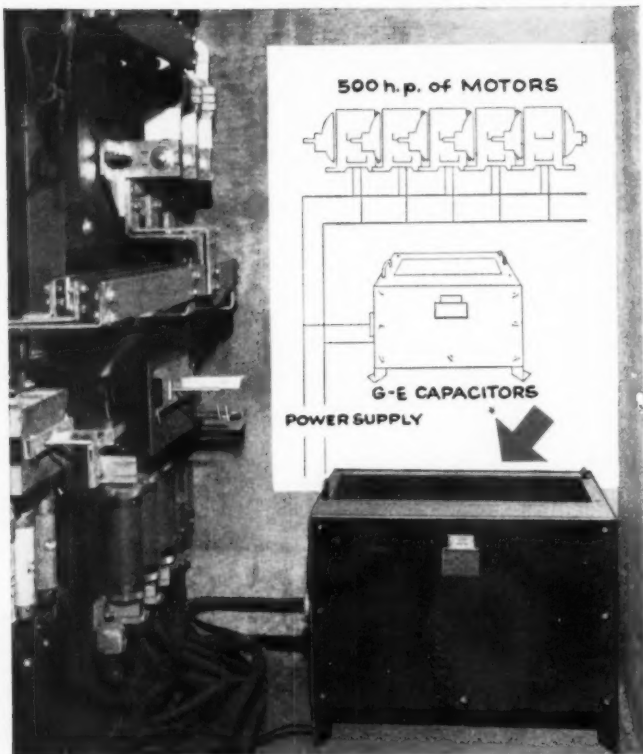
**RUDOLPH A. SCHERER**, Scherer Electric Co., Indianapolis, Indiana, is elected President of the National Industrial Service Association.



**CORRIDOR COVES**, one of many special lighting designs developed for the General Accounting Office building in Washington, D.C.

A MCGRAW-HILL PUBLICATION

**51**ST YEAR



Low power factor was penalizing a West Coast meat packing plant until G-E engineers recommended the installation (arrow) of a 60-kvar, 3-phase 60-cycle, 460-volt G-E capacitor equipment.

**\$355**  
**investment**  
**saves**  
**up to \$47**  
**every month!**

## **WEST COAST MEAT PACKING PLANT INSTALLS** **GENERAL ELECTRIC CAPACITORS AND CUTS POWER COSTS**

Induction motors caused low power factor. Because it takes about 500 hp of induction motors to run a plant that processes between 1500 and 2000 head of beef a day, a West Coast packing plant had a power factor that seldom got above 81%. Rebates on the plant's power bill were down to about \$3 a month.

**Power factor raised from 81% to 96%.** Then G-E engineers recommended the installation of 60 kvar of G-E capacitors at a total cost of \$355\*. After the capacitors were installed the power factor rose to better than 96% and stayed there. Rebates on the power bill now average between \$45 and \$50 every month. Thus, in less than nine months, the company realized a saving greater than the cost of the capacitor equipment. *And these monthly savings will go on indefinitely.*

\*Cost of capacitor equipment in 1949. Prices slightly higher now.

Capacitors can help in other ways, too! Besides raising power factor, capacitors often permit your present distribution system to carry 20 to 30% more load without added equipment. Where voltage drop is a problem, capacitors can also provide the needed voltage boost inexpensively.

**They're the key to lower power costs.** This West Coast plant is just one of the many that are cutting power costs with capacitors. If your power factor is below 85% and if there is a power-factor or kva-demand clause in your power contract, chances are you can make similar worth-while savings. Your local G-E sales office or authorized G-E agent or distributor can help you—or write to Section 407-207 for booklet GEA-5632—"How to Use Capacitors to Reduce Power Costs and Gain System Capacity." *General Electric Company, Schenectady 5, New York.*

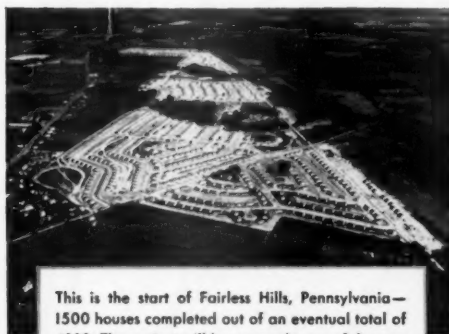
**GENERAL**  **ELECTRIC**

417-217



# Electrical Contractor on Fairless Hills Project tells why he likes **MURRAY EQUIPMENT**

John A. Humble, electrical contractor, President of Humble's Electric Company, Girard, Ohio, who is now working on 4000 new homes at Fairless Hills, Pennsylvania, has this to say about Murray equipment: "I like Murray because their boxes go up easy and there's plenty of wiring room. Those things are important on any job and real important on a job like this. A difference of only 5 minutes in wiring one piece of equipment, for instance, amounts to about 333 hours, when you figure on 4000 houses." Murray is supplying all meter mountings and a good percentage of main and range equipment on this job.



This is the start of Fairless Hills, Pennsylvania—1500 houses completed out of an eventual total of 4000. The project will house employees of the new U.S. Steel mill to be built in nearby Morrisville, Pennsylvania. Modern electrical appliances play an important part in this project. Each house is equipped with an electric range, a garbage disposal unit and an automatic washer.



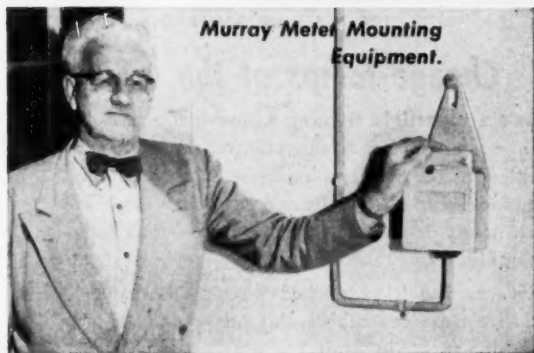
**MURRAY MANUFACTURING CORPORATION**

1250 Atlantic Avenue, Brooklyn 16, New York

Service Entrance & Meter Equipment • Fully Magnetic Circuit Breakers • Switches (Types A, C & D) • Current Limiting Reactors • Crows'nest Aerial Ladders



**Murray Main and Range  
Service Equipment.**



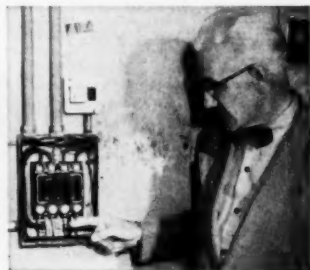
**Murray Meter Mounting  
Equipment.**

## MURRAY CAN SUPPLY **BOTH** METER MOUNTING AND SERVICE ENTRANCE EQUIPMENT

For a few homes—or thousands—Murray companion equipment will make your job easier. Companion equipment is easier to wire and easier to install because the units are designed to fit together. Companion equipment looks neater, too. On your next job—whether it's a bungalow or a huge development, ask your jobber for Murray Combination units. They're designed to fit together.

**"That's  
what I mean  
by plenty of  
wiring room—**

**My men like the  
Murray equipment  
and they do a neater  
and faster wiring  
job because of it."**



# NO ACROBATICS in lamp changing with— **APPLETON** **V-51** **VAPORTIGHT FIXTURES**

**WITH MALLEABLE IRON BODIES**  
100 WATT OR 150/200 WATT UNITS

## **Change lamps at the work bench!**

Here's a vaportight lighting fixture that sets a new high in safety, efficiency, ease of installation and maintenance! In the V-51, an exclusive "Unit Assembly" combines receptacle, globe and guard in a *single unit* . . . instantly detachable—without tools—for relamping or cleaning.

Reflector is quickly attached or removed—thanks to exclusive neoprene rubber ring suspension. Shock-absorbing socket in "Unit Assembly" permits the use of standard type lamps.

The new V-51 line includes 18 different types of rugged malleable iron bodies for pendent, ceiling or bracket mounting. *Complete interchangeability of parts* permits the assembling of 256 complete fixtures, using only 32 basic components!

Write for Bulletin 5-A containing complete details on the new Appleton V-51 Convertible Vaportight Fixture.



Malleable Iron Fixture Body 1/2" or 3/4" Hubs

Neoprene Rubber Ring Attachment

One of Four Reflector Styles Baked Porcelain Enamel Finish

Patent Applied for

Exclusive Unit Assembly (Receptacle—Globe Guard)

MALLEABLE IRON CONDUIT FITTINGS

**APPLETON**  
OUTLET BOXES AND SWITCH BOXES  
**ELECTRIC**  
INDUSTRIAL LIGHTING EQUIPMENT  
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# ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting. The  
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Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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**ELECTRICAL CONSTRUCTION and  
MAINTENANCE**

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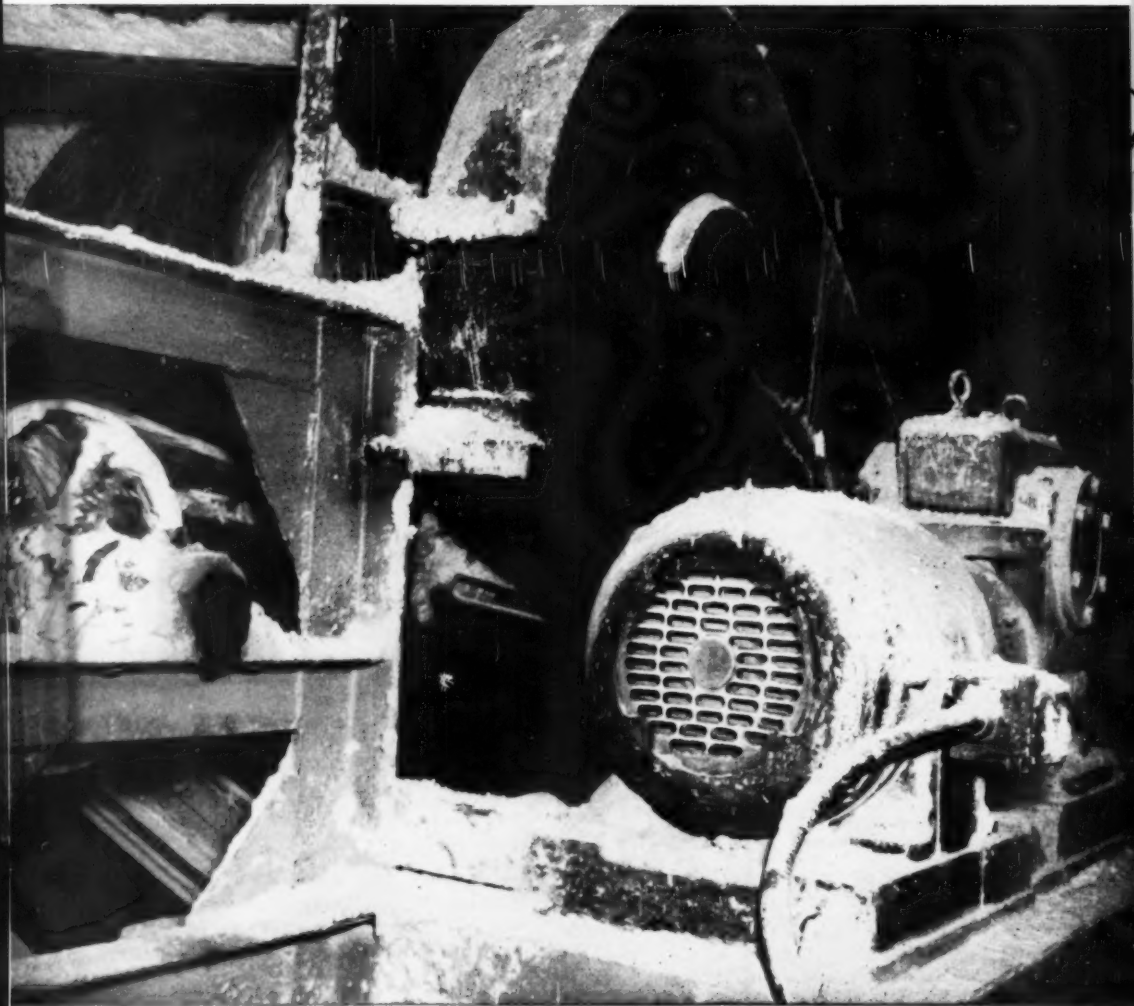
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# INDUSTRY DOES THE



**THE CHEMICAL INDUSTRY** depends on standard, "off the shelf," Tri-Clad motors in the most adverse operating conditions, including corrosive, abrasive and explosive

atmospheres. The 7½-hp totally-enclosed fan-cooled Tri-Clad motor above drives a crude ash conveyor an average of over 23 hours every day.

# GENERAL



# ELECTRIC

752-12

# TOUGH JOBS WITH

# **TRI-CLAD** MOTORS

REG. U.S. PAT. OFF.

## EXTRA PROTECTION

Every Tri-Clad motor, open or totally-enclosed, is triply-protected against *physical damage, electrical breakdown and operating wear and tear.*

That's why you'll find general-purpose Tri-Clad motors in every industry—not only on the usual jobs which they do so economically—but on the *tough* jobs where unflinching performance is a must.

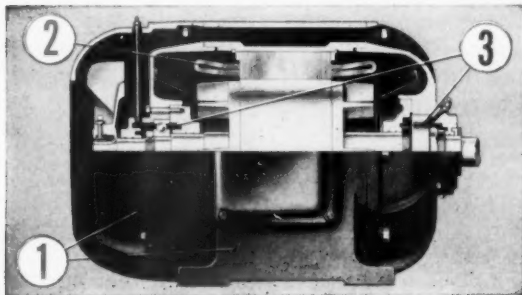
## PROMPT DELIVERY

Today especially, delivery and service are important. G-E shipping points all over the country are ready to deliver most standard ratings right out of stock. And with the most complete service shop network in the motor industry you are assured of the best attention to motor problems.

## TIMELY INFORMATION AVAILABLE

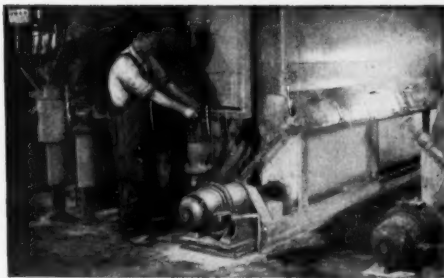
If you are concerned with training manpower, the new G-E Motor Selection and Application Course, including nine strip films, is a unique and valuable aid. A sample copy of the "Instructor's Manual" (GEZ-310), which outlines the course, may be obtained on request.

Also available is a free bulletin on "How to Maintain Motors and Generators" (GET-1202). Contact your local G-E sales office for any of the above material, or write Section 752-12, General Electric Co., Schenectady 5, N. Y.

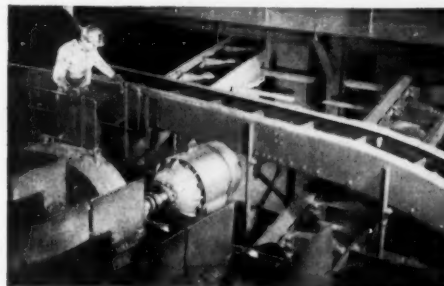


**UNINTERRUPTED SERVICE** under tough conditions is assured by many outstanding features of Tri-Clad totally-enclosed motors, for example: 1 rigid, cast-iron end shields and frame; 2 Formex<sup>®</sup> windings which resist oil, heat, shock, moisture, abrasion; 3 completely enclosed bearings that will last longer because provision is made for relubrication if necessary.

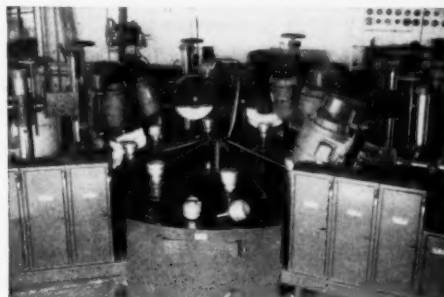
Reg. trademark of General Electric Co.



**FOOD PLANTS** on "continuous process" operation depend on Tri-Clad motors to avoid costly shut-downs. Totally-enclosed, non-ventilated Tri-Clad gear-motor above drives a repulper in a sugar refinery.



**MINING INDUSTRIES** know Tri-Clad motors can take abuse, don't twist out of line and are corrosion-resistant. This totally-enclosed, fan-cooled, Tri-Clad motor runs a coal conveyor.



**METAL WORKING FIELD** likes Tri-Clad motors because they're easy to mount in any position, rigid and smooth running, and can be relubricated if operating conditions warrant—without disassembly! Six 7 1/2-hp TEFC Tri-Clad motors run machine above which polishes 500 to 1000 metal coffee-makers per hour!





## A DEPENDABLE SIGN...

*that America is expanding*

Thanks in great part to you who harness electricity, America is expanding rapidly in the face of world tension.

As America strengthens its defenses, the YELLOW TRIANGLE REEL and the stack of Triangle conduit become more and more familiar sights. Engineers and contractors—demanding quality wire, cable and conduit—know that **YOU CAN DEPEND ON TRIANGLE and on the ELECTRICAL DISTRIBUTOR.**

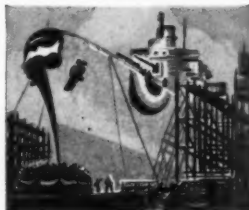
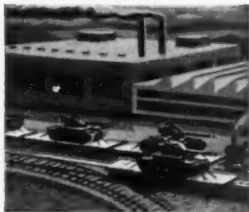
*The Trade Name  
of Top Quality*

**TRIANGLE CONDUIT & CABLE CO., INC.**

NEW BRUNSWICK, NEW JERSEY



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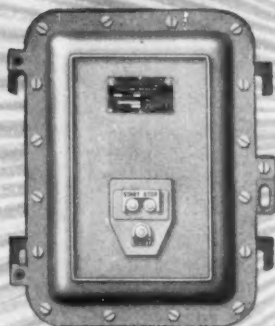


# CLARK Type "CY" AC MOTOR STARTERS

*in enclosures to meet every  
industrial requirement*



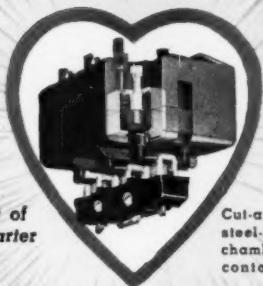
**Type IX Cast Iron,**  
explosion resisting en-  
closure for hazardous  
dust locations.



**Type VII Cast Iron,**  
explosion resisting en-  
closure for hazardous  
gas locations.



**Type IX Cast Iron,**  
explosion resisting en-  
closure for hazardous  
dust locations. A com-  
bination starter with  
circuit breaker.



*The heart of  
the CY Starter*

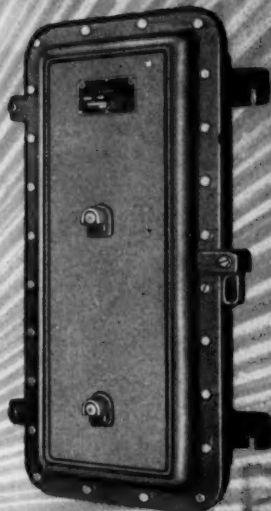
*Cut-away view of  
steel-enclosed arc  
chamber with main  
contact assembly*

In CLARK Type "CY" Starters, sizes 2 and 3, the arc is extinguished by the effect of the blowout coils, concentric with the contacts. The steel arc chamber and the center stud form the magnetic field which rotates the arc—either lengthening or confining it. Because the arc moves continuously on the contact surfaces, burning and pitting is minimized, and contact life greatly increased. These new starters are available in enclosures approved for use in such industrial atmospheres as hazardous gas, dust or excessive humidity.

**Type I Fabricated Steel,**  
general purpose enclosure.



Available Through CLARK Distributors.



**Type VII Cast Iron,**  
explosion resisting en-  
closure for hazardous  
gas locations. A multi-  
speed starter.



**Type V Dust Tight,**  
Fabricated Steel en-  
closure, with gasket  
and Wing Nuts.




**Type IV Cast Iron,**  
water tight enclosure.

## THE CLARK CONTROLLER CO.

# Now!

## HEAVY-DUTY DAY-BRITE CONSTRUCTION PLUS CFI \*

\* COMFORT FOR INDUSTRY



**These scientifically  
designed apertures  
make the difference—  
give the ideal 10% up-  
ward component of light.**

*... the first practical answer to  
industry's need for comfortable lighting*

Number one consideration in industrial lighting has always been rugged, durable construction . . . often at the expense of comfortable illumination. But in the past Day-Brite has consistently demonstrated that highest standards of lighting and highest standards of construction can be combined.

Now, after two years of research and study, we're ready to announce *another* great advance in industrial lighting.

To give industry even more comfortable and vision-saving illumination, Day-Brite has completely redesigned its famous Day-Line industrial line. The new CFI Day-Line is *comfort* engineered to give 10% upward light distribution and put an end to the harsh brightness contrasts and dark ceilings that hamper workers.

Now, workers can enjoy freedom from irritation and nervous fatigue due to eyestrain. Now, management can reap the benefits of more production, less work spoilage, higher employee morale and lower accident rate.

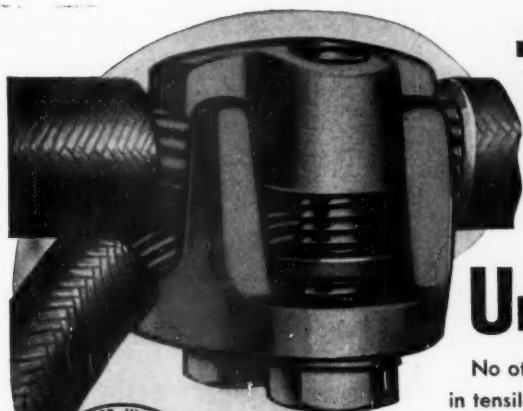
All the familiar Day-Brite features are still there, of course—die-formed heavy gauge steel construction, porcelain enameled reflectors, vibration-proof Turret sockets. And yet, CFI Day-Line prices are actually lower . . . actually mean substantial savings on industrial lighting installations.

See the Day-Brite distributor nearest you. Get the facts about this newest advance in plant lighting. Day-Brite, Inc., 5402 Bulwer Avenue, St. Louis 7, Missouri. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

248

IT'S EASY TO SEE WHEN IT'S





# Test after Test

has proved  
the PENN-TAP'S

## Unequalled Strength

No other fitting of this type has matched the Penn-Tap in tensile strength, in numerous tests to destruction. The reason is obvious:

The Penn-Tap is more sturdily constructed . . . exceptionally tough silicon bronze alloy and more of it (at no added cost).

For taps, service entrance connections, dead ends . . . indoor or out. Quickly installed with ordinary wrench.

ONE PIECE—no loose parts . . . swivels on one locked bolt. Holds tight permanently. 7 sizes, for cables 10 Str. to 1,000 MCM.

### Only one other Split Bolt Connector can take as high clamping pressures as PENN-UNION

Hundreds of competitive torque tests, of Penn-Union Split Bolt Connectors against other fittings of this type, have shown:

The Penn-Union Connector is *definitely stronger than all others except one, which closely follows Penn-Union design and is nearly equal.*

Excepting this one similar fitting, the Penn-Union Connector withstands clamping pressures 15% to 55% higher.

**MAKE THESE TESTS YOURSELF.** We will gladly furnish sample Penn-Union Connectors for tests against any other make. Just tell us the sizes.



Sold by Leading Wholesalers

**PENN-UNION ELECTRIC CORPORATION ERIE, PA.**

Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto

The *Complete* LINE of CONDUCTOR FITTINGS

# PENN-UNION



*Here's TOP Sangamo QUALITY  
in the Low Price Time Switch Field!*



SMALL IN SIZE  
HIGHLY ACCURATE  
SERVES A WIDE VARIETY  
OF APPLICATIONS



SINGLE POLE  
SINGLE THROW  
RATED 15 AMPS

Available in two attractive colors, Brown or Ivory. Type S has one "ON" and one "OFF" operation. Type SJ has two "ON" and two "OFF" operations. Ivory Case and Type SJ Switches are priced slightly higher.

Also available in Type SJ  
(Portable model with cord and plug).

## Sangamo Type S Time Switch

Here's a simple, sturdy, *low cost* switch with all of the fine quality you expect in a Sangamo Time Switch. It's a smooth-operating, precision-built time switch that is small in size, quiet in operation and highly accurate.

The Type S can serve in virtually any time control application where special operating features are not required. It permits you to offer Sangamo quality at low cost. It mounts on a standard switch box or on any wall.

See the Type S at your electrical wholesaler—compare it with other low priced time switches—you'll choose it for your next installation!

**SANGAMO ELECTRIC COMPANY**  
SPRINGFIELD, ILLINOIS



### SANGAMO QUALITY FEATURES:

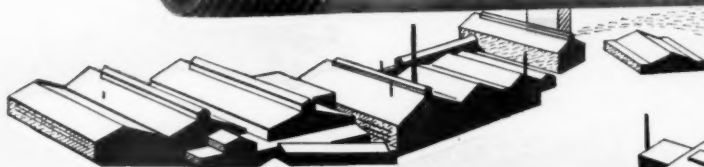
- Outside Manual Operation
- Easily Removable Cover
- Easy Time Adjustments
- Dead Front Safety Design
- Long Life Silver Contacts
- Precision Machined Gears
- Dependable Low-Speed Motor
- Lifetime Lubrication

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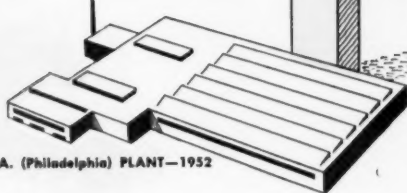


**Proudly . . . we announce  
our new company name, and  
our ultra-modern new Plant!**

Morrisville (Philadelphia), Pa.



ETHA, PA. (Pittsburgh) PLANT—1905



MORRISVILLE, PA. (Philadelphia) PLANT—1952

TWO PROUD EVENTS in our 50-year history—(1) the construction of our new plant adjacent to the Fairless steel works at Morrisville, Pa.—and (2) the conversion to using our nationally-accepted "Brand Name" as our new official company name . . . PITTSBURGH STANDARD CONDUIT COMPANY. The quality of manufacture so inherent in our Enameled Metals Company name—is now to be increased with new capacity, new modern equipment, greater steel tonnages, and faster service to our nation-wide markets.

Now more than ever, for better wiring protection, look to PITTSBURGH STANDARD—"The Standard of The Trade."

**Rigid Steel Conduit and E.M.T.**

Electro-Galvanized  
Black Enameled  
Hot Dip Galvanized  
Elbows, Nipples, Couplings  
Briegleb E.M.T. Fittings

The New Name for Enameled Metals Co.

**PITTSBURGH  
STANDARD  
CONDUIT CO.**

OFFICES:  
61 Bridge St.  
Pittsburgh, Pa.

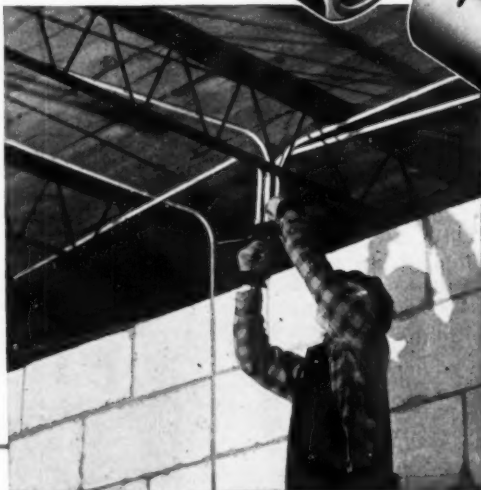
PLANTS:  
Etha, Pa.  
Morrisville, Pa.



# "SHAKER TOWERS"

*"Shaker Towers", Cleveland, Ohio,  
Shaker Coventry Corp., Owners; Joseph  
Caruti, Architect; Roediger Construction,  
Inc., General Contractors; Superior Light  
Co., Electrical Contractors.*

*Electricians like the ease of installing  
ELECTRUNITE E.M.T. in bar-joint  
construction. Accurate bends and stubs are  
easy to make with the exclusive inch-  
markings and the handy lightweight  
ELECTRUNITE Bender.*



**REPUBLIC STEEL CORPORATION**  
STEEL AND TUBES DIVISION  
224 EAST 131st STREET • CLEVELAND 8, OHIO

# where **ELECTRUNITE E.M.T.** helps keep electrical servants on the job

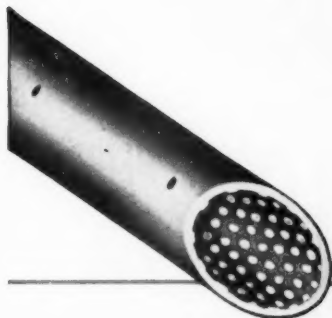
The circuits serving the tenants in this new 92-unit apartment are protected by the steel walls of **ELECTRUNITE E.M.T.** against fire, moisture, and mechanical damage. Tenants are protected from stray currents and shock by the automatic grounding system which only metal raceways assure.

**ELECTRUNITE E.M.T.** adds years to the life of any electrical installation . . . the galvanized end-to-end surface of **ELECTRUNITE E.M.T.**, unbroken by thread-cutting, makes this raceway last longer in concealed, exposed, or concrete-slab installations, for which it is approved by the National Electric Code.

Electricians tell us that **ELECTRUNITE E.M.T.** is easy to install . . . the exclusive "Inch-Marked"® feature speeds accurate cutting and bending . . . moisture-tight compression fittings eliminate thread-cutting, speed tight assembly without turning whole runs . . . exclusive *inside knurls* make wire-pulling easier.

\* \* \*

If you have extra-corrosive locations when even the best raceway material goes to pieces too soon, install **ELECTRUNITE "Dekor-Clad"** E.M.T. It's steel armored with plastic that is impervious to a long list of corrosive chemicals. Its cost is quickly offset by its much longer life in tough atmospheres. Write for literature.



**LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY**

# B-M *Fittings*

**ARE APPROVED AS  
CONCRETE-TIGHT**



When setting E. M. T. in concrete you can make each job easier and more profitable by using Briegel All Steel Indenter Fittings that have UL approval as CONCRETE-TIGHT. Contractors the world over recognize their cost cutting qualities and the fact that they make each wiring job a better job. It is only natural that Briegel Fittings are the most widely used E. M. T. connectors and couplings.



Cross Section  
Showing  
Indentations.



**BRIEGEL** **METHOD**  
**TOOL**  
**CO.**  
GALVA, • ILLINOIS

*Distributed by*

The M. B. Austin Co., Northbrook, Ill.; Clayton Mark & Co., Evanston, Ill.; Clifton Conduit Co., Jersey City, N. J.; General Electric Co., Bridgeport, Conn.; The Steelduct Co., Youngstown, Ohio; Pittsburg Standard Conduit Co., Pittsburgh, Penn.; Wagner Malleable Products Co., Decatur, Ill.; J. R. Richards Co., Carnegie, Penn.; Kandu Mfg. Co., Ltd., Preston, Ont.

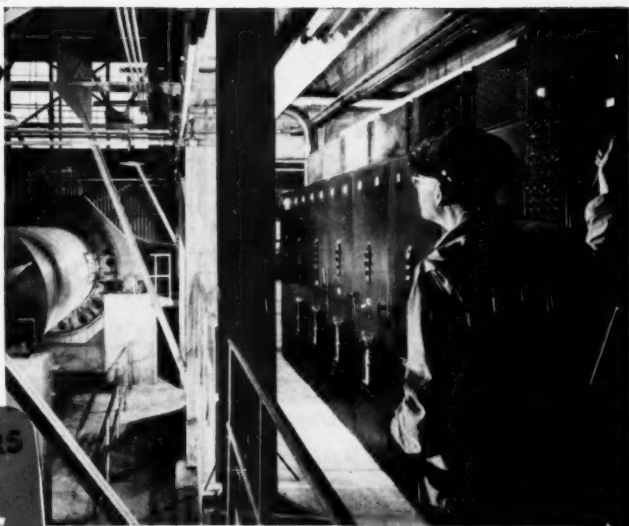
# CONTROL

*Engineered*  
for  
specialized  
industries

ALLIS-CHALMERS  
MOTOR  
STARTERS

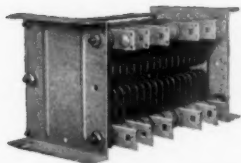


**THESE STARTERS** are designed to control the motors driving this high inertia load. They are full magnetic wound-rotor motor controllers. All the operator does is push the "start" button. Acceleration is automatic.



**LARGE BLOCKS OF CONTROLLED POWER** are used in many highly specialized industries. For example, grinding silica sand into powder fine enough for use in lamp bases, dinnerware, bathroom fixtures, abrasive wheels — even porcelain finishes for appliances — is the job of six tube mills like this one. Turning the mills with their heavy loads of sand and flint pebbles takes the power of six 125-horsepower, 440-volt motors controlled by specially engineered starters.

A-2671



**HEAVY DUTY RESISTOR BANKS** in the motor secondary circuit cut down current inrush. Time delay relays allow the proper interval of time for each accelerating contactor to close and cut out resistance in successive steps.



**WHEN 2500 TO 5000-VOLT** lines are available, select Type H Starters for similar jobs. Current-limiting fuses, safety interlocks, meters, relays . . . everything needed for your application is built in. Ask for Bulletin 14B6410A.

## ALLIS-CHALMERS

*There are Allis-Chalmers controllers for use in every industry . . . starters for squirrel-cage, wound-rotor and synchronous motors. For starters to 2500 hp and up to 5000 volts — check with your A-C representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin, for bulletins.*





## SORGEL AIR-COOLED DRY-TYPE TRANSFORMERS

# Sub-Stations and Power Centers

for indoor installations

## Engineered to meet your exact requirements

Not necessary to design or change your installation to fit a "standard"

**Any type of primary switch gear.  
Metering—primary or secondary, to suit.  
Secondary breakers, main, branch, or tie.**

Interlocked or automatic throw-over. Draw-out or stationary types.  
Magnetic trip, or thermal, or combination.

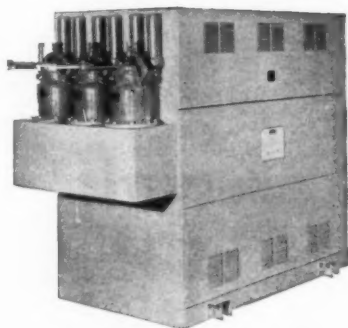
All incorporated with high quality, liberally designed  
**SORGEL Air-Cooled Transformers**

All factory wired, tested and assembled.

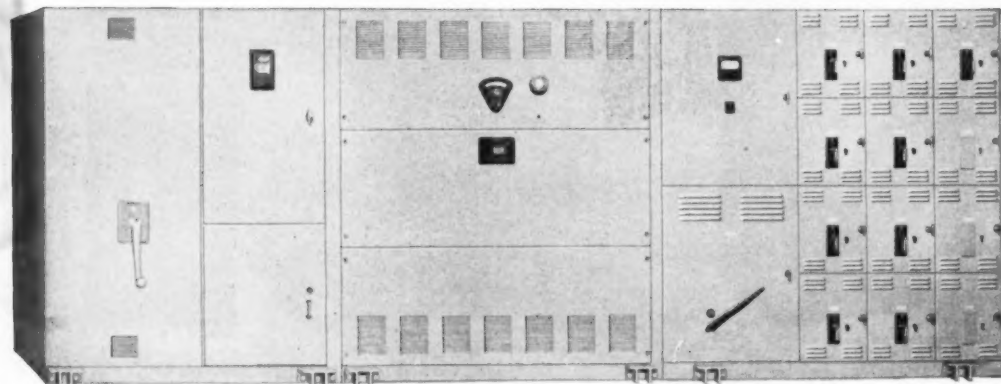
**Mounted on a substantial steel base**

Shipped as a single unit or in sections, accurately co-ordinated for  
**easy assembly on the job.**

**Sizes up to 2000 Kv-a. All voltages up to 15 KV.**



500 Kv-a, 3-phase, 4160 volt Transformer,  
equipped with primary oil fuse cutouts



2000 Kv-a, 3-phase, 13,200 volt unit Sub-Station  
With forced draft fans, automatically controlled by temperature indicator to  
increase transformer capacity 25%; primary fused load break switch and  
kilowatt-hour meter, secondary voltmeter and drawout circuit breakers.

## Also a Complete Line of Conventional Air-Cooled Dry-Type Transformers

1/4 to 2000 Kv-a. Single phase and poly-phase. 120—240—480—600 volts.

*Sales Engineers in Principal Cities*

**SORGEL ELECTRIC CO., 836 West National Ave., Milwaukee 4, Wis.**

*Pioneers in the development and manufacturing of Air-Cooled transformers*

# Interested in \$500 trifles?

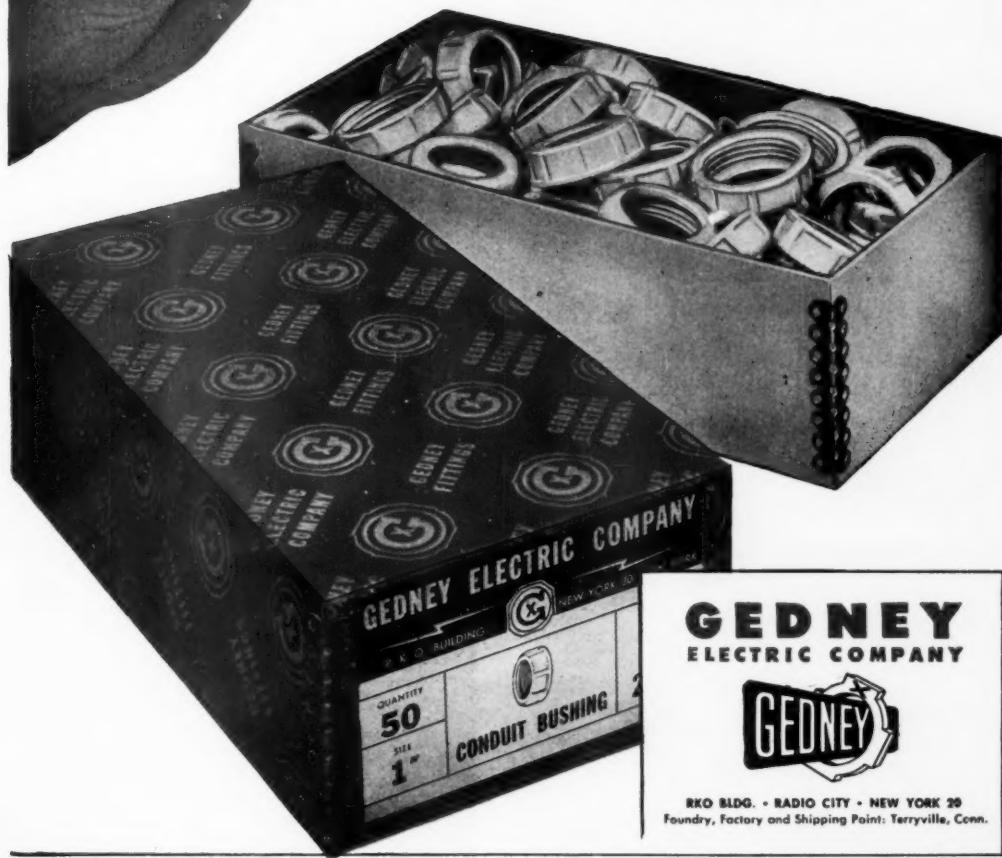


ONE MINUTE LOST is a mere trifle. But lose one minute out of ten while installing fittings — take 10% too long for the job — and you lose \$500 worth of trifles per man per year...Gedney Fittings *stop* such losses, for Gedney's are machined with absolute accuracy and slash your installation time. Order them now.

## GEDNEY FITTINGS FIT!



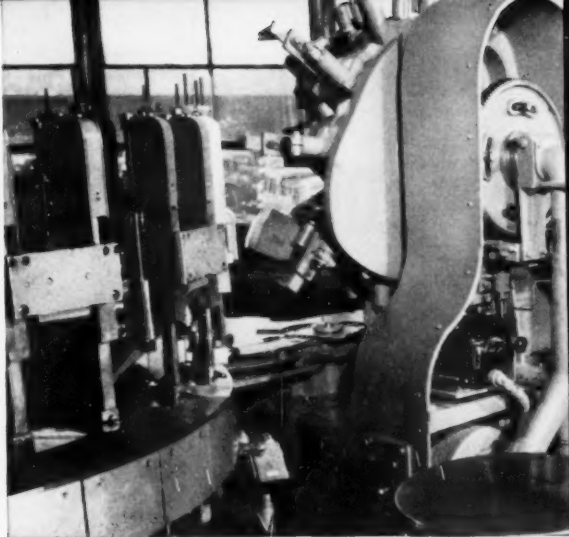
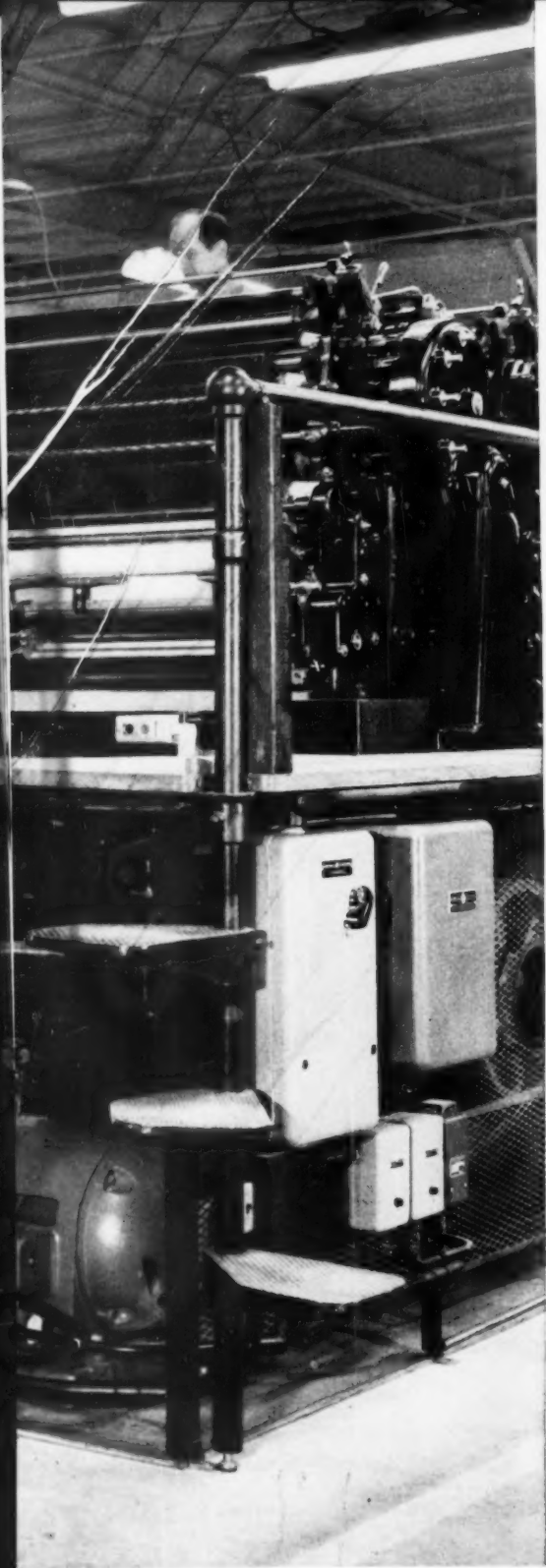
- ★ Accurate malleable iron castings... stop breakage
- ★ Threads are machined to closest tolerances.
- ★ Reinforcing ribs for extra strength... extra grip.
- ★ Smoothed shoulder protects the wire.



**GEDNEY**  
ELECTRIC COMPANY



RKO BLDG. • RADIO CITY • NEW YORK 29  
Foundry, Factory and Shipping Point: Terryville, Conn.



◀ **THE LORD BALTIMORE PRESS**, in their new \$2 million plant, chose G-E magnetic starters for long-lasting protection on this huge Harris TTL press. Main drive is controlled by a full-voltage, fuse disconnect, reversing G-E magnetic starter, while two more G-E magnetic starters protect feeder and delivery motors.

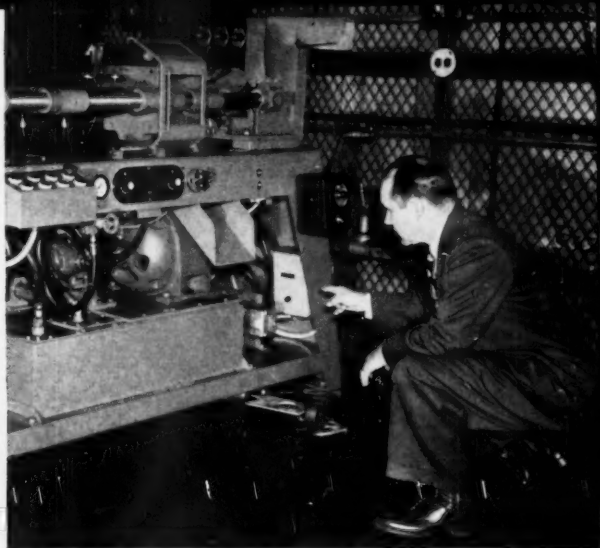
## Three more leading "G-E Magnetic



**EASY INSTALLATION** is another reason companies prefer G-E starters. Here, one is being installed on a Pneumatic Scale Corp. labeling machine. Note accessible wiring terminals all in front.



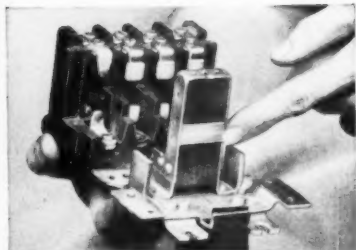
**PNEUMATIC SCALE CORP. LTD.** makes complex bottling and packaging machinery. They report that G-E magnetic starters give dependable service, fool-proof motor protection. Above, Pneumatic "bottling line" is being assembled. It cleans, fills, caps and labels—uses G-E magnetic starters to protect its motors.



**THE VAN DORN IRON WORKS'** Sales Manager J. J. Reichel, pointing to Van Dorn plastic molding machine, says, "G-E magnetic starters are the best long-term assurance we can give customers against motor burn-outs. We've used them on over 1000 machines and never a complaint on electrical equipment."

## industrial plants report:

# Motor Starters last longer!"



**NO FAILURE** after millions of operations is assured by exclusive features such as *permanent air gap* in magnet, above. It can't "wear out" because it is independent of striking surfaces . . . prevents "sticking in" of magnetic structure.



**EXCLUSIVE STRONGBOX COIL** shuts out dust, oil, moisture; can't be damaged by slipping screwdriver—only maintenance tool needed.

The Lord Baltimore Press, Baltimore, Md., the Van Dorn Iron Works, Cleveland, Ohio, and Pneumatic Scale Corp., Ltd; Quincy, Mass. are among the thousands of companies now profitably using G-E Magnetic starters for longer lasting protection.

This extra long life is due to many exclusive G-E features, such as the permanent air gap, cold-moulded arc chute, and the famous G-E "Strongbox" Coil. General Electric magnetic starters eliminate metal-to-metal friction, have permanent lubrication, self-cleaning silver contacts . . . everything you need to operate and protect your motors . . . longer.

**WIDEST VARIETY:** General Electric manufactures the most complete line of motor starters. You have your choice of all popular NEMA sizes in General-purpose, watertight, dust-tight and explosion-proof enclosures. Also, G-E starters are easily modified to meet special requirements.

**OFF-THE-SHELF DELIVERY:** You can get G-E starters, right now, by contacting your nearest G-E Apparatus Sales office or authorized distributor. For more information, send coupon today. *General Electric Co., Schenectady 5, N. Y.*

**GENERAL**  **ELECTRIC**

Section A730-37, General Electric Co., Schenectady 5, N. Y.

Send me your new bulletin GEA-5781 on G-E magnetic and manual starters, and control accessories ☐ for planning an immediate project ☐ for information only.

NAME  TITLE

COMPANY

ADDRESS



## .. where space is a problem

... the Fairbanks-Morse Axial Air Gap Motor is the solution to your motor drive problems. For this unique motor is 40% shorter ... 30% lighter than conventional models.

Like all motors that bear the Fairbanks-Morse Seal, the Axial Air Gap has the traditional strength, balance and electrical stability that assure you maximum service life.

Whether you are interested in a single motor, or thousands—one type and size, or a variety of types and sizes—you'll find that Fairbanks-Morse Motors are designed and built to fill your needs.

When you look for electric motors—for standard or unusual applications—*always* look for the Fairbanks-Morse Seal. For over 120 years it has stood for the finest in manufacturing integrity to *all* industry. Fairbanks, Morse & Co., Chicago 5, Ill.



# FAIRBANKS-MORSE,

**a name worth remembering**

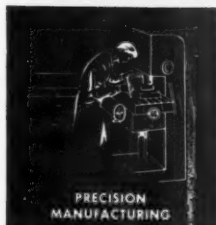
ELECTRIC MOTORS AND GENERATORS • DIESEL LOCOMOTIVES AND ENGINES • PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • RAIL CARS • FARM MACHINERY • MAGNETOS



# P&S WIRING DEVICES



EXPERIENCED  
ENGINEERING



PRECISION  
MANUFACTURING



CONSTANT  
TESTING



ELECTRICAL WHOLESALER  
DISTRIBUTION

To be sure  
ORDER BY P&S  
CATALOG NUMBER

Write for  
a Catalog

## IT'S EASIER... IT'S FASTER TO WIRE THE P&S SURFEX® WAY

Now Available in All-Plastic or Porcelain Base Types

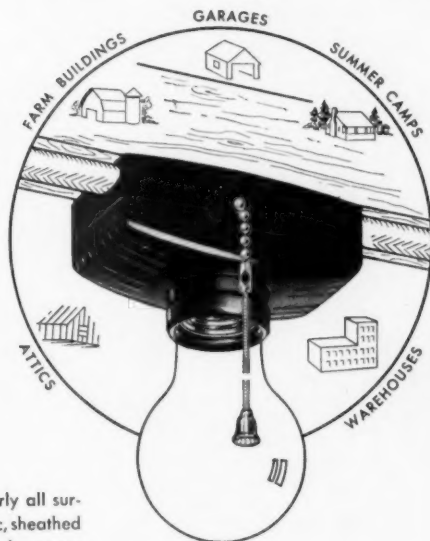
### EASY TO WIRE

A Neat, Modern Installation in three easy steps

- (1) Mount the Device
- (2) Run the Wire
- (3) Connect to Terminals

### SAVES TIME

Everything you need for installation in a single package. No Boxes—No Taping—No Soldering.



There's a Surfex device for nearly all surface wiring jobs where non-metallic, sheathed cable is used—single pole and three-way switches, keyless and pull lampholders, duplex outlet, rosette and junction box.

Both the P&S All-Plastic type (8661 series) with arc-resisting Urea Base and the Porcelain Base type (661 series) give the surface job better appearance and insure long and satisfactory service. The All-Plastic type is provided with back knock-outs which make back wiring possible.

P&S Surfex Meets Federal and REA Specifications  
Approved by Underwriters' Laboratories

Either All-Plastic or Porcelain-Base Surfex provide these important features:

- Buss bars for third wire or feed-thru connections
- Knockouts for knob and tube wiring
- Large wiring chambers
- Easy wiring terminals—no wire loops or splicing necessary
- Knockouts for No. 12 or No. 14 standard non-metallic sheathed cable (2 or 3 wire)
- No. 8 round head wood screws for mounting
- T-rated Switches—Double Grip Outlets

Write Department W for complete information—and insist on P&S Surfex for every surface wiring job.

P&S  
TIME-TESTED  
DEPENDABILITY

## PASS & SEYMOUR, INC.

SOLVAY STATION

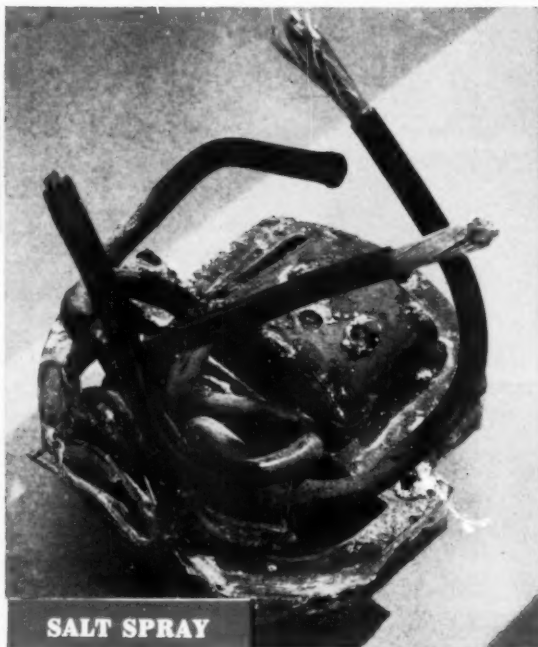
SYRACUSE 9, NEW YORK

THE BEST COSTS LESS in the long run

...in the Westinghouse types CA & CS meters



# withstand after three



**SALT SPRAY**

The entire electromagnet was immersed in brine for 3 months. Here it is after being removed. The U-S-S AMPYROL was completely unaffected, and easily withstood the 12,000 volt breakdown test.



## ***A STANDARD Cable for***

- ▶ paper & varnished cambric cables
- ▶ asbestos cords and cables
- ▶ aerial, underground & submarine cables
- ▶ shovel and dredge cables

# U-S-S AMERICAN ELECTRICAL

# U·S·S Ampyrol coils 12 kv breakdown test months in salt water!

EVERY watt-hour meter is literally a "cash register" for some power company. As such, it must be extremely accurate.

The Westinghouse meter shown here remains accurate for years—mostly because of an engineering program that continually searches for ways to make the meters even *more* accurate while remaining unattended and exposed to the elements for years on end. For example: Westinghouse pioneered the ball and sapphire bearing, and practically eliminated a major source of wear. They even go so far as to *gold plate* every gear in

the gear train, so that they will not corrode and slow down the meter.

Now, Westinghouse has taken another major step forward in design by switching to U·S·S AMPYROL for the important current winding in these watt-hour meters.

American Steel & Wire engineers worked closely with Westinghouse, and developed a special non-fogging polyvinyl insulation that has excellent electrical and physical properties; yet it will not give off fumes that cloud the meter glass. As part of a rigorous test procedure, Westinghouse engineers immersed the entire electromagnet in a brine solution for 3 months. After removal, the AMPYROL wire easily withstood a 12,000 volt breakdown test. In another test, AMPYROL was held in an oven at 212°F. for 2 months. When removed, it was just as good as new and tested perfectly.

The full range of tests showed that U·S·S AMPYROL would eliminate leakage current due to faulty insulation, thereby assuring long range meter accuracy.

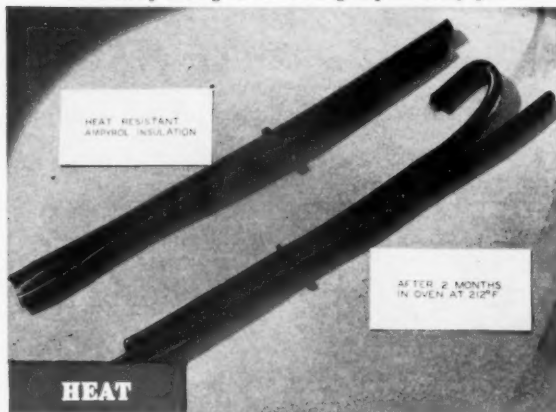
How has this insulation actually stood up in service? Hundreds of thousands of AMPYROL equipped meters are now in service; and the insulation is performing perfectly despite the moisture, industrial fumes, salt air, ultra-violet rays from the sun and extreme heat and cold.

This is just one of many uses for U·S·S AMPYROL. It is widely used for re-wiring old buildings because the thin jacket allows more wire to be pulled through the same size conduit. AMPYROL is an important part of many machine tools because it strips clean, is available in many brilliant colors to simplify installation, and is unaffected by cutting oils and grease. AMPYROL is even used for exposed electric sign wiring because rain, sun and cold do not affect it.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL COMPANY

GENERAL OFFICES: CLEVELAND, OHIO

IN THE WEST—COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO  
IN THE SOUTH—TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.  
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



Two months at 212°F. had no effect on U·S·S AMPYROL. When removed, the insulation passed all physical and electrical tests.

every ***SPECIAL Job!***

- ▶ oilproof portable cords
- ▶ plastic machine tool & building wire
- ▶ special purpose cords & cables



## WIRE & CABLE

### SEND THE COUPON

American Steel & Wire Division  
Room AE-62, Rockefeller Building, Cleveland 13, Ohio  
☐ Please give me more information on U·S·S AMPYROL.  
☐ Have representative call.

Name.....  
Title.....  
Company.....  
Address.....  
City..... State.....

UNITED STATES STEEL

# PARAMOUNT FRICTION TAPE by Haartz-Mason

**1**


**STRONG!**



Made under the most exacting requirements in the industry, Paramount Friction tape can be tightly wrapped — yet can be torn readily as required. A margin of safety in this respect is added to every roll of Paramount Friction tape.

**2**

**FREE OF PINHOLES!**



In order to assure maximum insulation and protection against moisture, friction tape should be as free as possible from pinholes. The materials and methods and new equipment used in making Paramount Friction tape assure virtual non-existence of pinholes.

**3**


**WON'T RAVEL!**



Automatically cut with smooth, neat edges on Cameron cutting machines. These machines wind it on the cores under tension. This is your insurance against raveling.

**4**

**PLENTY OF ADHESION!**



Under controlled temperature and humidity, Paramount Friction tape is strictly tested for permanence of adhesion.

**5**


**AGES SLOWLY!**



Taken from stock at regular intervals, sample rolls of Paramount Friction tape undergo accelerated aging tests in an electric oven at 212°F. for 16 hours. Thus you get a guarantee of maximum aging ability.

**6**

**CUT EXACTLY TO SPECIFIED LENGTH!**



Every roll of Paramount Friction tape is sold with guaranteed minimum footage per roll plus... guaranteed weight. You are left in no doubt about what you are getting. And so you know you will cover the largest area most efficiently at the lowest cost.

**7**

**PRE-TESTED AT THE FACTORY!**



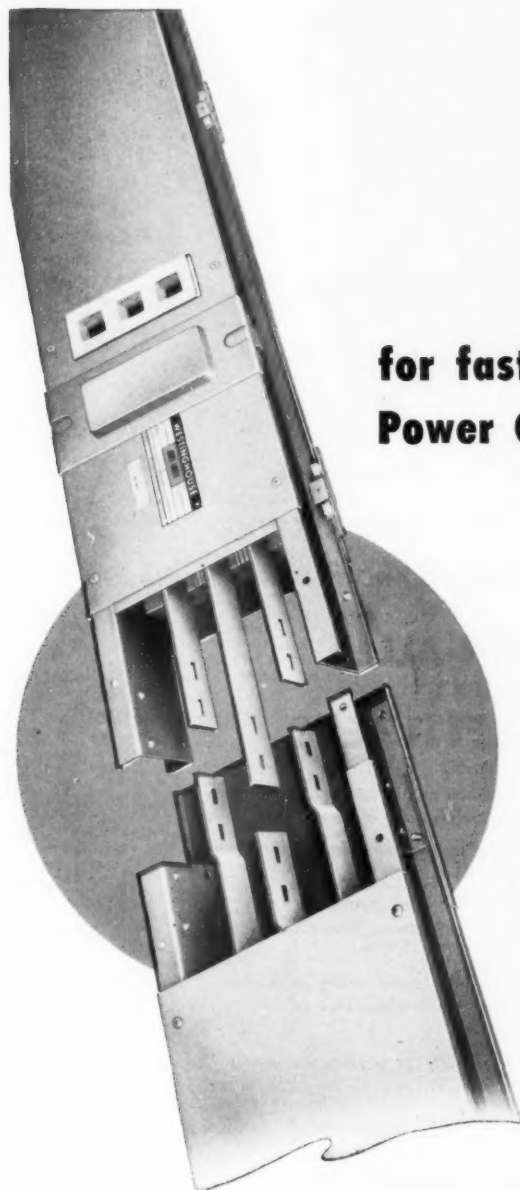
To sum up, Paramount Friction tape, besides being made of finest materials, also undergoes rigorous pre-testing at the factory. Among the rigidly conducted tests are those for aging, adhesion and strength.

**Dual Guarantee on Weight and Length**




Manufactured by  
**Haartz-Mason, Inc.**  
WATERTOWN 72, MASS.





# BUS DUCT IS FLEXIBLE

**for faster, lower cost  
Power Conversion or Expansion**

Wasting time unraveling wire mazes? Wasting money "doubling up" on cable? Check these points of convenience provided in Westinghouse Bus Duct to speed power-line layout, simplify installation.

- Prefabricated sections, any length . . . convenient to handle, mount, and install with channel-type splice plates (illustrated).
- Plug-in receptacles every foot . . . eliminate long, secondary cable runs, facilitate rapid machine tie-ins, any time.
- To extend power-line runs . . . simply add sections of duct.
- To relocate duct . . . dismantle, rearrange, remount . . . no cable slicing or splicing; equipment fully salvageable; minimum outage time.
- Standardized ells, tees, crossovers . . . no problem with tight layouts, turns in any plane.
- Cantilever hangers . . . quickly aligned and bolted.
- Higher carrying capacity pound for pound than cable or conduit.
- 4 types of Westinghouse Bus Duct meet all load requirements, any service condition from transformer to machine.

Call your Westinghouse distributor for the full story, or write for Bus Duct Manual B-4272A, Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-30057

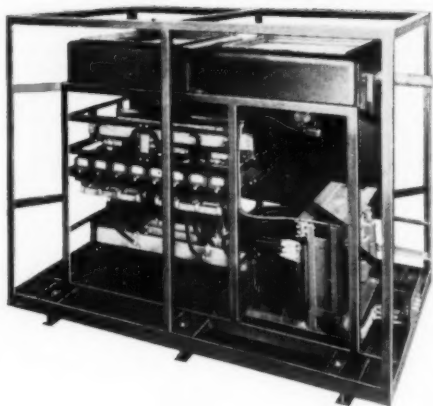


YOU CAN BE SURE... if it's  
**Westinghouse**



**BUS DUCT**





THE APPLICATION OF THE PRINCIPLE OF  
**"HEAT EXCHANGE"** TO SELENIUM RECTIFIERS  
 OPERATING IN CORROSIVE ATMOSPHERES IS ANOTHER FIRST FOUND IN

## **RICHARDSON-ALLEN** DEPENDABLE **SELENIUM RECTIFIERS**

We now offer a complete rectifier unit which operates on the "heat exchange" principle, wherein the selenium stacks are sealed off from plating room atmospheres.

It may be safely installed in corrosive surroundings without danger to the selenium stacks, to the transformer or to any other components.

This development from the laboratories of Richardson-Allen greatly widens the field of application of selenium rectifiers for d-c power. Whatever your problem may be, it will be to your advantage to bring it to us.

This new Richardson-Allen design may be used with entire safety near cleaning or pickling vats, in chemical factories and laboratories, in mines, and in other locations where corrosive atmospheres are prevalent.

Complete technical information will be sent promptly to engineers and others who depend upon d-c for vital operations.

*See our exhibit at the Industrial Finishing Exposition, International Amphitheatre, Chicago, June 16-20.*

### **RICHARDSON-ALLEN CORPORATION**

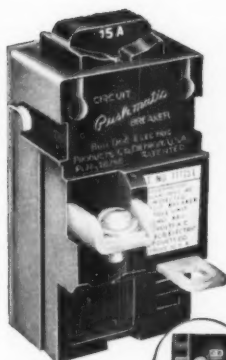
*a manufacturing affiliate of*  
**WESLEY BLOCK AND COMPANY**

**39-15 MAIN STREET, FLUSHING, NEW YORK**

IN CANADA: Richardson-Allen of Canada, Ltd., 370 Victoria St., Toronto, Ontario



**DEPENDABLE POWER FOR EVERY DC NEED**



**Just push  
the button!**

**Famous, Foolproof Pushmatic**

Circuit Breakers are individual, interchangeable units that provide automatic, trip-free circuit protection always. Rupture circuits instantly when trouble occurs. Need no resetting. A simple push restores service. Available in 15, 20, 30, 40 and 50 amps. Install and wire quickly, simply... give unmatched flexibility to all Bulldog Electric-Centers. Guaranteed. Listed by Underwriters'.

**New low price!**



**P2B Electric-Centers**  
with Pushmatics. Fully flexible, adapt to any job, on the job... available in minutes from local suppliers' stocks. Up to 42 circuits.

**New low price!**

# Bulldog Reduces Pushmatic Prices

**Now... save up to 35% on genuine  
Pushmatic Circuit Breakers,  
Electric-Centers, Accessories**

**Yes, all Pushmatic prices have been drastically reduced!**

And there has been no sacrifice in quality, no change whatsoever in the products. You save up to 35% on genuine Pushmatic® Circuit Breakers, Electric-Centers and Accessories; yet get all the well-known Pushmatic advantages at prices you pay for ordinary circuit breaker equipment.

Popular demand, new production facilities make this reduction possible. A new Bulldog plant (Bellefontaine, Ohio) is devoted exclusively to producing the Pushmatic line. Production is up, costs down... you share in the savings when you buy Pushmatic.

Now, no need to let price make you settle for second best. See your local Bulldog Distributor. Compare the flexibility, ease of installation and other fine features of Pushmatic Electric-Centers against other equipment. Compare the new low price.

Then, stock and install the Bulldog Pushmatic line.



**XD Electric-Centers**  
for homes, small businesses. Feature split bus bars, Pushmatic protection, one central control for all home circuits. Accommodate up to 18 circuits.

**New low price!**



**Service Electric-Centers**  
also equipped with modern, safe Pushmatic Circuit Breakers. Adapt quickly, easily to present, future needs. Eliminate fuses. Up to 8 circuits.

**New low price!**



## BULLDOG

**BULLDOG ELECTRIC PRODUCTS COMPANY**

DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES  
IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO  
PIONEERS IN FLEXIBLE ELECTRICAL DISTRIBUTION SYSTEMS

1902-1952... SERVING INDUSTRY FOR 50 YEARS WITH FINER ELECTRICAL PRODUCTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE... JUNE, 1952



---

WHAT ***Life-Lines*** REALLY DELIVER IS MORE SERVICE...LESS SERVICING

# What Life-Lines really deliver is ...more service ...less servicing

"We can't afford equipment breakdowns. We manufacture ice cream making machinery and operate franchise stores throughout the country. Store operators know very little about maintenance. We must select equipment that assures trouble-free performance with minimum maintenance. That's what Life-Lines give us. That's why we standardize on them."

The above statement by the chief engineer of an eastern manufacturing plant tells the Life-Line story best. Summed up it means more service, less servicing with Life-Lines.

**Take the Life-Linestarter<sup>®</sup>, for example.** Contacts last longer because exclusive "De-ion<sup>®</sup>" arc extinction snuffs out arcs fast... reduces contact pitting. Simple seesaw balance of clapper prevents accidental opening; kickout spring prevents accidental closing. Compare with any other starter and see why Life-Linestarters offer *more service with less servicing*.

**The Life-Line motor's advance design** completely eliminates periodic lubrication. Pre-lubricated factory-sealed ball bearings need no greasing attention. Throw your grease guns away! Further, steel construction cuts breakage from rough usage. Superior insulation and winding techniques lengthen electrical life. On-the-job reports of a half million Life-Lines show why you get more service with less servicing.

It costs no more to get Life-Line performance. Ask your Westinghouse representative for details or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

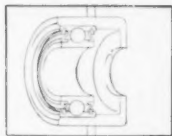
J-21684



YOU CAN BE SURE...IF IT'S  
**Westinghouse**

**Life-Line**

MOTORS and CONTROLS



#### MOTOR

*Needs no lubrication.* Pre-lubricated factory-sealed bearings eliminate troubles due to under or overlubrication, dust and dirt.

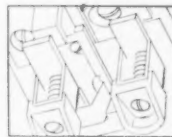


*Cuts winding burnouts.* Pear-shaped slot design eliminates pockets. No corner voids remain to collect dirt, moisture.



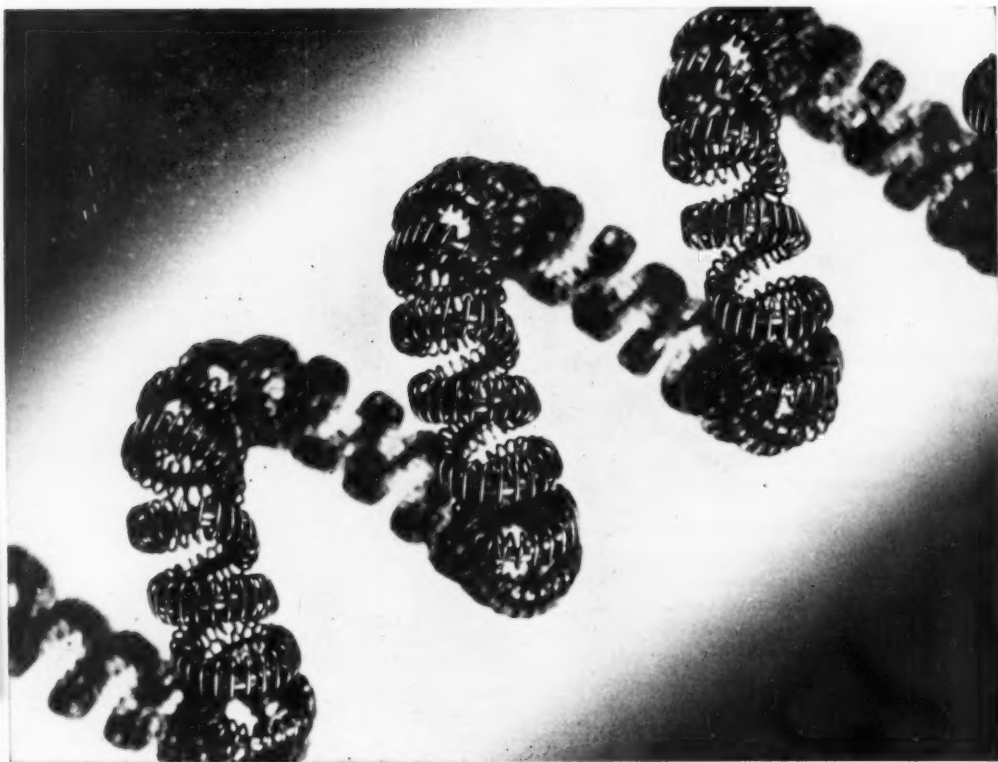
#### STARTER

*Never jams.* No sliding surfaces to wear—no sticking—no jamming—nothing to wear or replace.



*Never needs filing.* Silver-to-silver contacts eliminate filing. Discolored silver maintains high conductivity.

# New G-E fluorescent lamp starts fast, needs no starter



**T**HE triple coil filament developed by General Electric, and shown greatly magnified above, now makes possible another great new fluorescent lamp! It's the G-E RAPID START fluorescent lamp. Combined with General Electric's new RAPID START ballast, it starts with quick 1-2 action. There's no starter needed, so maintenance is easier, costs less. Flicker is eliminated. Hum is reduced to a minimum.

**G-E RAPID START** fluorescent lamps will be available soon. This newest development of General Electric research is another reason why you can expect the best value from G-E fluorescent lamps.



*You can put your confidence in—*

**GENERAL  ELECTRIC**



# PARKWAY CABLE



**Save the cost of duct systems!...with the most dependable Parkway Cable you can buy!**

ROEBLING'S research staff is continually working at the job of product development. Our manufacturing facilities and techniques are constantly improved. That's why our Parkway Cable for distribution and general power supply circuits is today even more dependable than ever before.

Roebling Parkway Cable saves money right from the start because it is buried directly in a shallow, low-cost trench. It is made in single and multiple conductor — solid or stranded — in a range from

600 to 5,000 volts... furnished with metallic armor or a non-metallic *Roeprene* sheath, depending on the physical protection required. Types that pass all C.A.A. requirements for Specification No. L-824 for airport lighting are also available.

Large quantities of Roebling's full line of electrical wires and cables are needed in the rearmament program. We and our distributors will do everything possible, however, to meet your requirements. John A. Roebling's Sons Company, Trenton 2, N. J.

# ROEBLING

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 5 PITTSBURGH ST. • CHICAGO, 5525 W. ROOSEVELT RD.  
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 DETROIT, 915 FISHER BLDG. • HOUSTON, 5216  
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 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST.  
 • PHILADELPHIA, 230 VINE ST. • PITTSBURGH  
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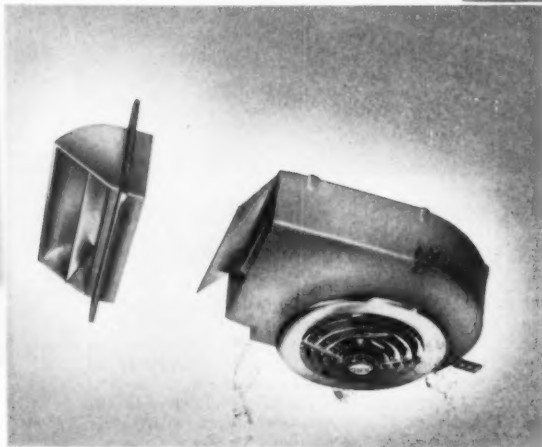
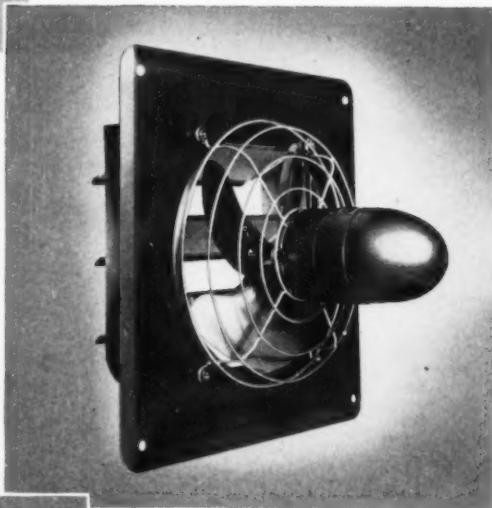
# SIGNAL

## THE FANS WITH ADDED SALES APPEAL

### Shutter-Attached Vent Fan Offers Single, Easy Installation!

SIGNAL's V-700 Series are compact, completely-assembled units; just fit into a wall-opening from the inside and attach!

- 8", 10", 12" and 16" models deliver 500, 700, 1200 and 1600 C.F.M. respectively.
- Enclosed, rubber-mounted induction motors with self-lubricating bronze bearings.
- 4-pole motors on all but 16" model, which has a 6-pole motor.
- Wide, deep-pitched 4-petal blade assemblies on all but 16" model, which has a 6-petal blade assembly.
- Gravity-type hooded shutters with replaceable aluminum vanes which operate in unison.
- Light but strong welded-steel frame permits use on thin-wall construction.
- 3-speed flush or surface mounted controllers available for more versatile operation.
- Attractively finished in durable hammered gray enamel.



### Quality-Built Household Ceiling Or Wall Fan!

SIGNAL's attractive CW-100 solves home ventilation problems. Can be installed in either ceiling or side wall.

- 4-pole induction motor with oilless-type porous bronze bearings is totally enclosed and rubber-mounted.
- Blade is of centrifugal design to maintain high static pressure; moves 480 C.F.M. at 1520 R.P.M.
- Frame is of heavy cast aluminum; chromium plated grille easily removed without tools.
- One aluminum shutter vane in frame and another in weatherhood provide double backdraft protection.
- Weatherhood has a detachable 5" sleeve for use in brick wall construction.
- Over-all depth only 3 3/4" . . . fits between 16" center joists or studs . . . accommodates standard 3 1/4" x 10" furnace duct.
- 3-speed flush-type controller with chrome-plated face-plate is available.

### Send today

for SIGNAL's new 1952 catalog featuring a complete line of:  
Desk Fans • Floor Fans • Pedestal Fans • Window Fans • Exhaust Fans  
Shutter-Attached Vent Fans • Kitchen Vent Fans • Electric Drills • Grinders  
Fractional Horsepower Motors

# SIGNAL

ELECTRIC MFG. COMPANY, MENOMINEE, MICHIGAN

# Easy to install, too...

## Easy-to-Make Connections Speed Hookup of...



### HOW IT'S DONE ON RATINGS

10 KVA AND SMALLER — single phase  
25 KVA AND SMALLER — three phase  
FRONT AND BOTTOM PLATES drop out to give plenty of working space. Removable front plate permits you to work from the side instead of directly under unit. That means safer, faster, easier installation.



### HOW IT'S DONE ON RATINGS

15 KVA AND LARGER — single phase  
37 1/2 KVA AND LARGER — three phase  
SOLDERLESS CLAMP CONNECTIONS reduce hookup time to a matter of minutes. Just remove top cover and then clamp leads to easily accessible solderless connectors. On sizes above 50 kva — single phase, and 100 kva — three phase, flat drilled bars are arranged vertically for any style of connector.

**ALLIS-CHALMERS**  
**Dry-Type**  
**TRANSFORMERS**

EASIER INSTALLATION is just one of the reasons why you'll like Allis-Chalmers dry-type transformers.

In addition, they're light and compact because they're *Fiberglass* insulated. They're *Sprayed* for added protection against rust. And coils are impregnated to protect windings from moisture and dirt.

Get more information about these Allis-Chalmers Class B insulated dry-type transformers. Ratings: 167 kva and smaller (single phase); 300 kva and smaller (three phase), 600 volts and below.

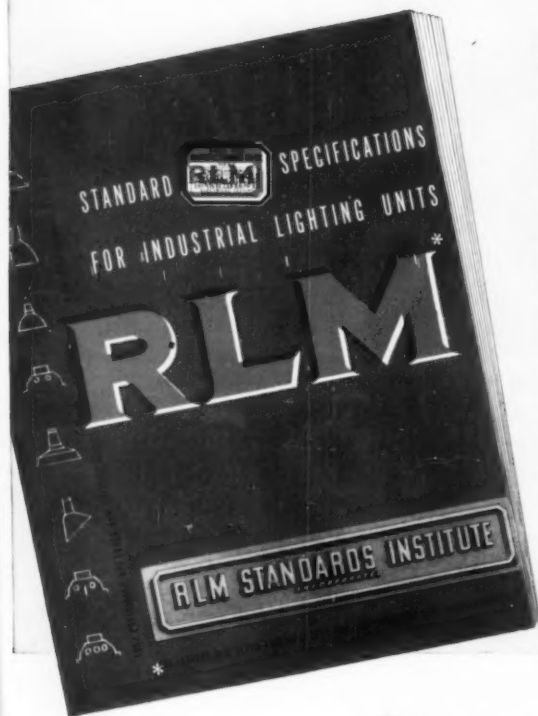
Contact your nearby Allis-Chalmers dealer or sales office, or write for Bulletin B6382. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3733

# ALLIS-CHALMERS



# The RLM Standards Institute Announces its 1952 ENLARGED EDITION of the RLM Specifications Book



## USEFUL

Latest RLM Lighting Data:  
Coefficient of Utilization Tables  
Light Distribution Curves  
Typical Reflector Shapes

## UP-TO-DATE

Two New RLM Specifications:  
No. 4 RLM 300-1500-w Porcelain Enamelled Reflectors for High Mounting  
No. 40 RLM 300-1500-w Aluminum Reflectors for High Mounting

## HELPFUL

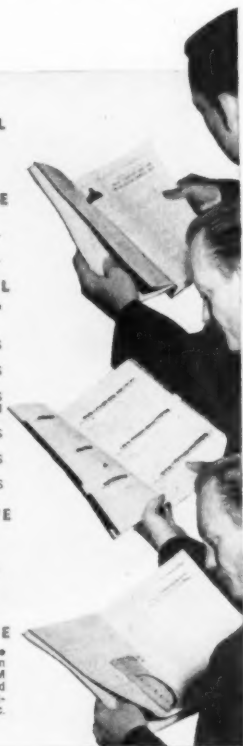
Clarification of Ballast and Slimline Lamp Standards on  
RLM Fluorescent Specifications:  
Nos. 5, 6 RLM 48" CLOSED END UNITS two and three-lamp  
Nos. 9, 10 RLM 48" OPEN END UNITS two and three-lamp  
Nos. 22, 23 RLM 48" TWO-LAMP UNITS with LONGITUDINAL SHIELD open and closed end  
Nos. 7, 11 RLM 60" TWO-LAMP UNITS open and closed end  
Nos. 28, 29 RLM 72" OPEN END UNITS two and three-lamp  
Nos. 30, 31 RLM 96" OPEN END UNITS two and three-lamp

## AUTHORITATIVE

Revisions of and Additions to RLM Incandescent Specifications:  
No. 1 RLM DOME REFLECTOR  
No. 2 RLM DEEP BOWL REFLECTOR  
No. 3 RLM SYMMETRICAL ANGLE REFLECTOR  
No. 18 RLM GLASSTEEL DIFFUSER

## INFORMATIVE

Easy-to-Read, Illustrated "Story of the RLM Label". The need for standards in industrial lighting... History of the RLM Institute... How the RLM Inspection and Certification Program works... The Importance of Porcelain Enamel... etc.



Published as a contribution to the advancement of the Science of  
Industrial Lighting, and as an aid to everyone who buys, sells,  
recommends or specifies Industrial Lighting Equipment.

You are invited to obtain your complimentary copy of this latest reference work on industrial lighting equipment. Architects, lighting engineers, electrical contractors, etc. recognize the RLM STANDARD SPECIFICATIONS BOOK as an authoritative aid in the specification, recommendation and purchase of industrial lighting units. It is the only industrial lighting book which helps evaluate lighting units in terms of illumination, construction and performance standards. Further, the RLM Specifications Book provides ready-made specifications which assure industrial lighting units that meet approved minimum standards of quality.

The 1952 Edition is designed to be even more helpful. It contains newly-approved specifications and latest revisions, and for the first time, valuable coefficient of utilization and light distribution data. Thus the user has at his fingertips the complete picture on each RLM unit. If

your work is concerned with industrial lighting equipment, a copy of the 1952 Edition RLM SPECIFICATIONS BOOK is available to you without cost or obligation. Write RLM Standards Institute, Suite 819, 326 West Madison Street, Chicago 6, Illinois, for your free copy.





## R&S DUST-TIGHT LIGHTING FIXTURES

... for hazardous locations where flammable or explosive dusts are present. Class II, Groups E, F, G and Class III.

### With 2 Exclusive Design Features

Now R&S engineering contributes a new and important stride forward in Type DL lighting fixture construction and installation simplicity!

R&S Type DL Lighting Fixtures operate very cool—way below allowable temperatures for this class of installation. They provide safe and efficient illumination for all locations where flammable or explosive dusts constitute a hazard.

Two R&S exclusive design features, added to the basic advantages common to other well-constructed dust-tight fixtures, are an important advance that assures faster, easier installation, and cleaning and relamping. Fixtures are made of rugged cast aluminum alloy—designed with smart streamlined simplicity—and shaped to prevent dangerous accumulation of dust particles. For detailed information and prices write for Data Sheet No. 7151-4.



**1** Lampholders are located within the conduit box assembly of both pendent and junction box types, permitting installation and wiring without regard to size or style of fixture.



**2** All fixture—globe—Reflector assemblies fit either base and are easily attached or interchanged by means of a simple bayonet slot and screw arrangement, without disturbing electrical connections.

Pendent and Junction Box bases are standard to all fixtures. They will accommodate any style fixture—globe—reflector assembly in either 100 watt or 200 watt sizes, providing complete interchangeability.



RUSSELL & STOLL COMPANY, INC. • 125 BARCLAY STREET, NEW YORK 7, N. Y.

D-7

# RUSSELL & STOLL

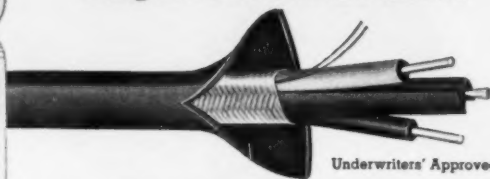
PRECISION-BUILT ELECTRICAL EQUIPMENT—SINCE 1902



# Take advantage of the

## Rome RoBarn

**Neoprene Sheathed Cable**



Underwriters' Approved

**For non-rotting farm wiring**

## RoMarine - RoPrene<sup>®</sup>

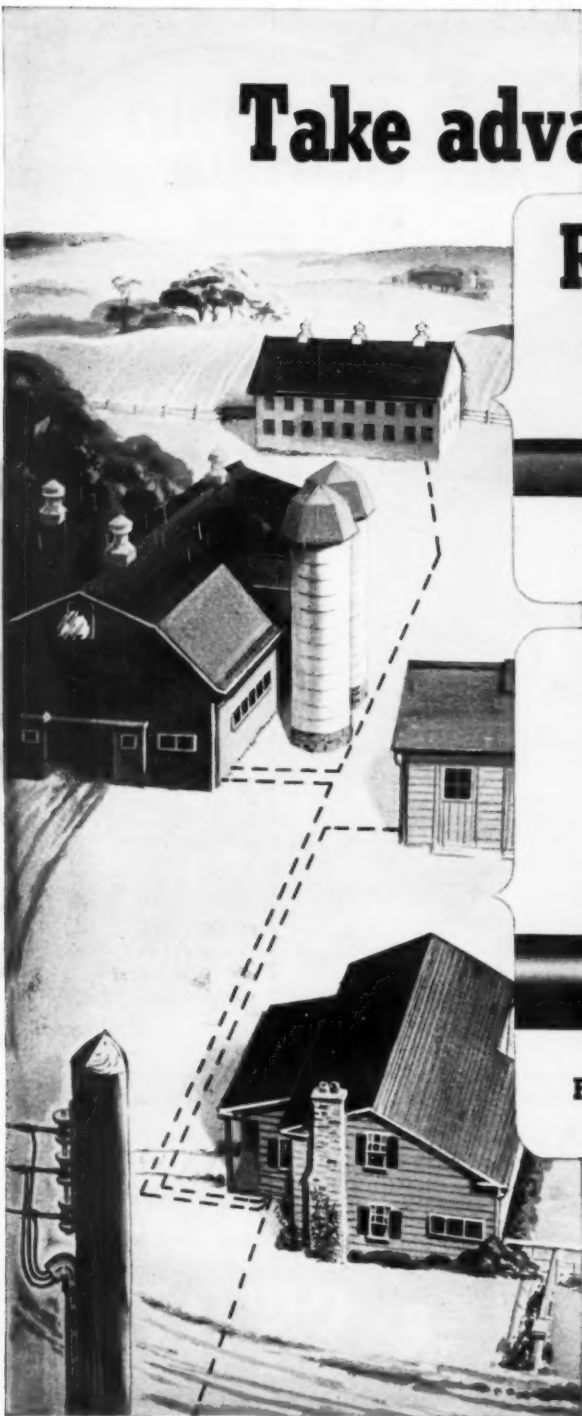
**All-Purpose Power Cable**



Underwriters' Approved as Type USE

**For Underground Services and Circuits  
Between Buildings**

Typical underground farm wiring installation. Dotted line indicates RoMarine-RoPrene used both as an underground service cable from pole to house and for underground power distribution from building to building. Rome RoBarn is used to wire the buildings.



# Big Market for Farm Wiring

More and more farmers want to expand electrification to include barns and outbuildings. That's where Rome RoBarn comes in. Especially made for wiring all farm buildings, RoBarn is Underwriters approved for use in cow barns and other hazardous locations where it would be subject to heat, cold, moisture and fungi. Insulated and sheathed with Neoprene, and reinforced with a special glass braid, RoBarn cannot absorb moisture . . . will not support flame. It also resists ammonia fumes, uric acid, mechanical injury and is *completely non-rotting*. It's easy to use, too. Diameters are uniformly small, providing increased space in outlet boxes. Sheath and insulation strip cleanly.



RoBarn is immune to livestock excretions and ammonia fumes.



Protected by Neoprene, it cannot absorb moisture, rot or support flame.

Farmers also realize the advantages of underground wiring. They know it's safe from ice loading and windstorms. It won't snag tall machinery and is less of a lightning hazard.

RoMarine-RoPrene offers the perfect solution to the farmer's underground wiring requirements. It is Underwriters approved for direct earth burial, service entrance from pole to meter and for underground power circuits from building to building.

A high quality rubber insulating compound (RoMarine) gives it excellent resistance to heat and moisture. Its RoPrene (Neoprene) sheath resists soil acids and alkalis, as well as oils and physical abuse. Light in weight, RoMarine-RoPrene is easy to install and can be terminated with simple manual connections. Splicing and tapping are easy, too.

Learn more about this highly effective farm wiring combination and how you can use it to get your share of the big farm market. Just mail the coupon.



RoMarine-RoPrene can be buried direct in earth without additional covering.



Can be used as service cable from pole to meter—or for underground circuits between buildings.

***It Costs Less to Buy the Best***

**ROME CABLE**

*Corporation*

ROME • NEW YORK

and  
TORRANCE • CALIFORNIA



ROME CABLE CORPORATION, Dept. CM-6, Rome, N. Y.

Please send me material checked:

☐ RoBarn Bulletin ☐ Bulletin RR-1 (RoMarine-RoPrene)

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

## BOSCH BREWING COMPANY REPORTS:



### No outages...no maintenance... "We FORGOT WE HAD Transformers"

"The trouble-free service we received from Westinghouse Dry-Type Transformers actually caused us to *forget they had been installed*," says the General Manager, Bosch Brewing Company, Houghton, Michigan.

"We solved a tough installation problem by fitting them into a crowded wall space where neither a larger transformer or a disconnect switch could have been located," says the contractor, Coon's Electric Shop, Hancock, Michigan.

For five years, two 10-kva Westinghouse Dry-Type Transformers operated with *no outages, no maintenance* . . . decreased a critical heavy load on 3-phase power circuits caused by expanding plant facilities . . . eliminated the need for a separate lighting service.

You can meet the demands of changing elec-

trical loads most economically with Westinghouse Dry-Type Transformers. Easily mounted wherever power is needed, their small size and light weight make them easy to install. Mounted close to load centers, they cost less to operate, reduce power losses. Available with or without built-in breakers. Get a more complete story from your local Westinghouse representative. Or write to Westinghouse Electric Corporation, Transformer Division, Sharon, Pennsylvania.

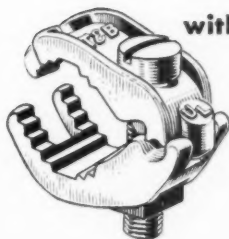
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YOU CAN BE SURE...IF IT'S  
**Westinghouse**

**DRY-TYPE  
TRANSFORMERS**



# HANDLE LOTS MORE grounding jobs in lots less time



with multi-purpose,  
easy-to-use T & B Ground Clamps\*

Take along just *two* types of T & B Clamps—and you can take on *most* any grounding job! #3846 handles #6 or 4 bare wire... #3847, #8, 6 or 4 armored. Both make a tight, lasting, *non-crushing* connection to copper tubing... water pipe... ground rod—in  $\frac{1}{2}$ " and  $\frac{3}{4}$ " sizes.

Tighten just *one* screw on #3846 for an electrically sound, mechanically durable joint between wire and electrode. Tighten just *one more* screw on a #3847 for a lasting grip on the armor too!

One-piece construction—no loose parts to get lost. Ideal for installation in dark, cramped quarters.  
*UL approved, of course!*

## ENGINEERED RIGHT... DISTRIBUTED RIGHT!

Ground Clamps #3846 and #3847 are typical of the many T & B quality fittings recently re-designed to give you outstanding performance at lowest installed costs. Like all T & B fittings, they're furnished under the T & B Plan 100% through your local T & B distributor.



THERE'S A  
**T & B**  
**ENGINEERED**  
**PRODUCT**  
for every  
wiring job  
in the  
complete T & B  
line of fittings  
for all  
conductors and  
raceways.

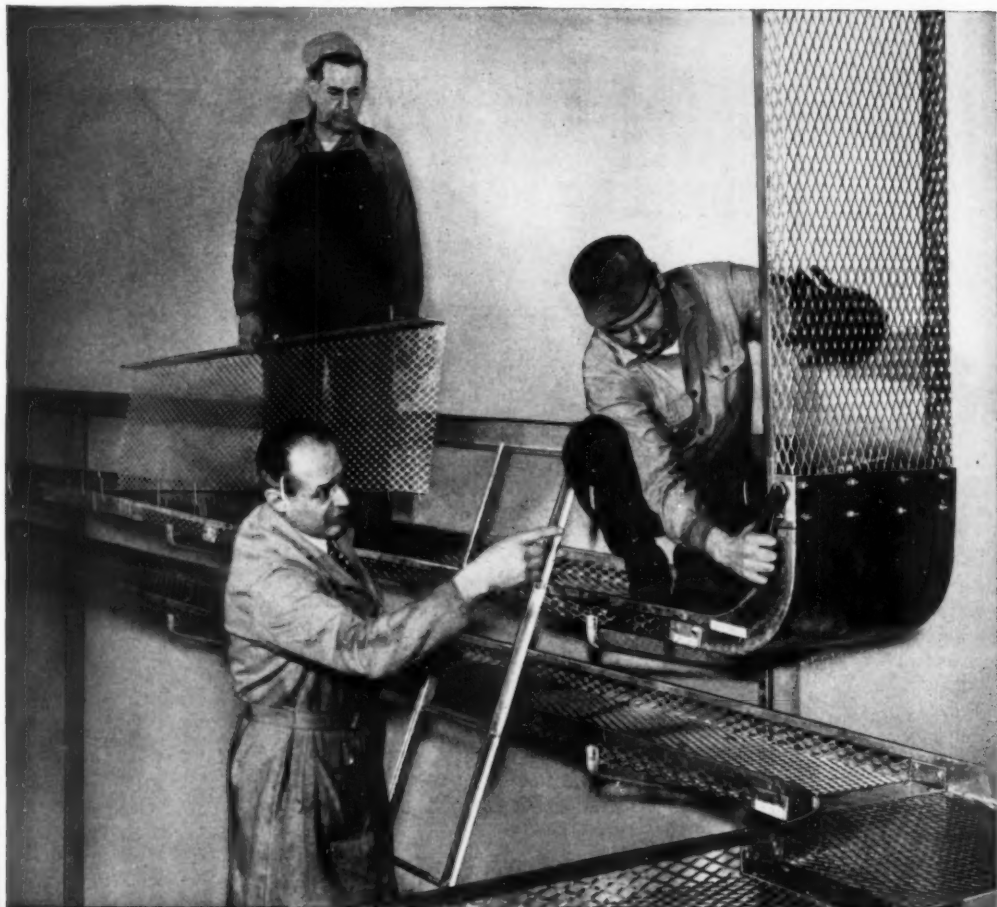


## THE THOMAS & BETTS CO.

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34 Butler Street  
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MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1898





LIGHT

.... **BUT STRONG!**

COPE Cable Trough is both strong and light. These two important factors help to give you a simple and versatile standard system for supporting cable, which will save you in . . . material, man hours and costs.

Write today for full information on COPE Cable Trough.

*You know Cope by  
these products*



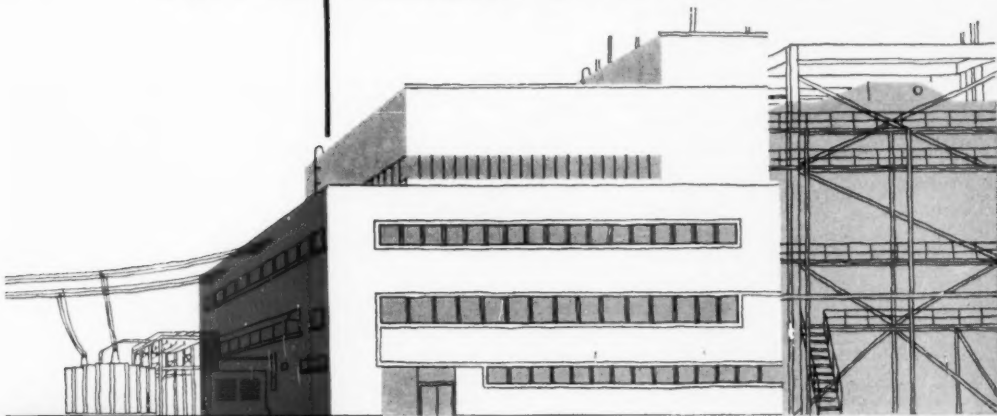
T.J. *Cope* INC.

711 South 50th St. Philadelphia 43, Pa.



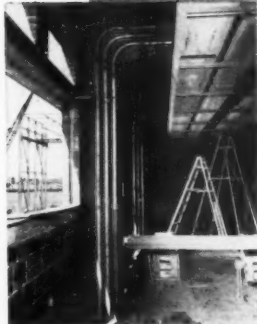
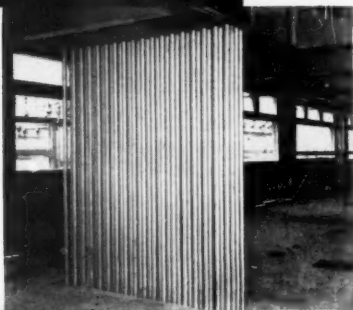
*In Florida  
at Jacksonville's New Power Plant*

**THEY'RE EXPERTS IN HOT CIRCUITS**



**...THEY APPROVED**

**SPANG® CENTRAL CONDUIT**



Two-inch Spang Conduit on circuits for controlling and metering 69,000 volt switchyard.

Control and metering of 13,200 volt switchyard and transformer protection for one 15,000 KVA and two 37,500 KVA transformers is through two-inch Spang Conduit.

The men who designed the new South Side Generating Station at Jacksonville, Florida, are specialists in equipment for handling power . . . high voltage and low voltage. They designed for peak operating dependability around the clock, day after day.


Which makes particularly significant their approval of Spang Central Conduit . . . for all control systems and many other needs in this ultra-new power station. When power engineers approve an electrical product, *you can be sure it's good.*

That's why we urge you to standardize on Spang whenever you want the utmost in dependability. It's a quality-controlled conduit . . . made from carefully selected steel, formed under exact heat conditions, inspected constantly—manufactured to give exactly the right bending, cutting, and threading characteristics. All features that will cut your installation time and costs.

Be sure to specify Spang "Cenlaco", "Central Black", "Central White", "Central EMT" for a guarantee of year after year of trouble-free service. You'll find it will pay!

The Builders were:

Engineers & Architects: Reynolds, Smith & Hills, Jacksonville, Florida  
General Contractor: George D. Auchter Company, Jacksonville, Florida  
Electrical Contractor: Cleveland Electrical Company, Jacksonville & Atlanta



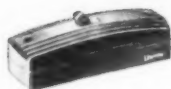
**SPANG-CHALFANT**  
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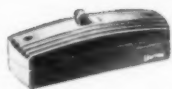
# quality wiring devices

the complete line  
for  
industrial  
commercial  
and residential  
use

Recently added items to the LEVITON line, some of which are shown on this page, have met with wide response throughout the electrical industry, and attest to the ever-growing popularity of LEVITON wiring devices. The New LEVITON Chicago warehouse now offers increased facilities for prompt delivery of high quality wiring devices.



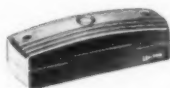
LEV-O-LET No. 5233



LEV-O-LET No. 5231



LEV-O-LET No. 5230



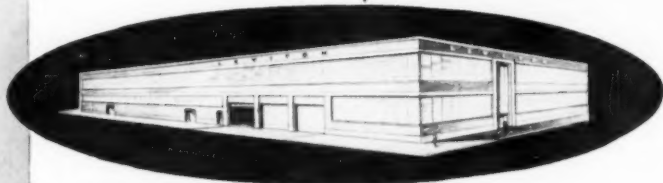
LEV-O-LET No. 5237



LEV-O-LET No. 5236



LEV-O-LET No. 5235



New LEVITON Chicago Warehouse



No. 5027



No. 5020



No. 5024

**LEVITON MANUFACTURING COMPANY**

main office: Brooklyn 22, New York • plants: Brooklyn N.Y., Hills Grove, R.I., Pawtucket, R.I.  
warehouses: Chicago and Los Angeles



Visit the LEVITON Booth No. 71A at the Wholesalers Convention

An important splice in progress on a 3/c, 500 MCM, 26,400 V shielded paper-lead feeder cable for Public Service Electric and Gas Company's new Warren Point Substation at Fairlawn, N. J.



# Public Service Electric and Gas Company insures continuity of service *with* **NATVAR** Splicing Kits



Veteran splicers in the Underground Department like Natvar splicing kits, because they provide exactly the right number of rolls of v.c. tape cut to proper lengths and widths, and exact quantities of other materials required for the job. Engineers and foremen like the kits because they give close "quality control" of the splicing operation, with a minimum of waste and spoilage.

Public Service is working around the clock to provide adequate service for one of the fastest growing areas in the country. Long range planning demands that additional facilities to meet the increasing load be built on a permanent basis.



## Natvar Products

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished silk
- Varnished special rayon
- Varnished Fiberglas cloth
- Silicone coated Fiberglas
- Varnished papers
- Slot insulation
- Varnished tubing and sleeving
- Varnished identification markers
- Lacquered tubing and sleeving
- Extruded plastic tubing and tape
- Extruded plastic identification markers

Ask for Catalog No. 22

For this reason, extreme care is exercised in the selection of equipment and materials for the expansion program. Natvar splicing kits, made up in units for various sizes and types of cable, speed underground splicing because of their convenience and insure uninterrupted service because of the uniformly high quality of the materials.

All Natvar flexible insulations have excellent physical and electrical characteristics, and are dependably uniform, no matter where or when purchased. They are available either from your wholesaler's stock or direct from our own.

## **NATVAR** CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

TELEPHONE

RAHWAY 7-8800

CABLE ADDRESS

NATVAR: RAHWAY, N. J.

205 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

THE  
**COMPLETE LINE**  
FOR  
**COMPLETE SAFETY**

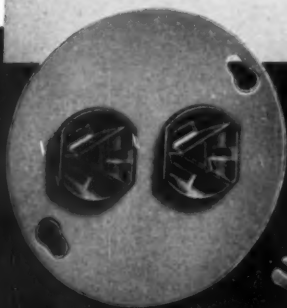


**POLARIZED**  
**WIRING DEVICES**

COMMERCIAL

INDUSTRIAL

RESIDENTIAL



No. 7119



No. 4474



**2-3-4 WIRE**

**10-50 AMPS**

**250 VOLTS**

*Including*

SINGLE and DUPLEX  
FLUSH and SURFACE RECEPTACLES



RANGE and  
POWER OUTLETS

CORD CONNECTORS  
and CORD GRIP CAPS

No. 4474

WEATHERPROOF  
POLARIZED RECEPTACLES



No. 7802



No. 7310



No. 7118

No. 7896



No. 7313

Wherever heavy duty loads are handled, look to this complete line for easy-to-install, dependable wiring devices. Here is in-built safety to protect both equipment and user. The longer ground blade makes contact first, breaks last. Positive polarity is assured at all times by the blade-slot design that makes improper insertion virtually impossible.

You'll find that our fully illustrated catalog is a handy reference guide full of useful ordering information about the complete line of polarized and other devices. It can help make your next wiring job safer, easier and better. Send for your free copy today. Just write to:

**1706 Laurel Street, Hartford 6, Conn.**

Branches in: Boston, Chicago, Dallas, Denver, Detroit, Los Angeles, New York, Philadelphia, San Francisco, Syracuse. In Canada: Arrow-Hart & Hegeman (Canada) Ltd., Mt. Dennis, Toronto.



CALL YOUR NEARBY

**ELECTRICAL DISTRIBUTOR** FOR PROMPT SERVICE

WIRING DEVICES  
ENCLOSED SWITCHES



HART & HEGEMAN DIVISION

**THE ARROW-HART & HEGEMAN ELECTRIC CO.**  
HARTFORD 6, CONNECTICUT

# "maintenance time cut 50% "

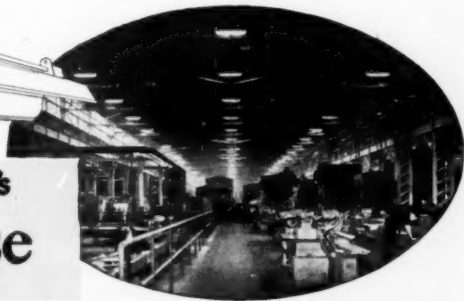
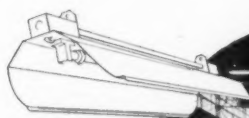
*with Westinghouse MERCURY lighting*

A typical customer's problem: "To reduce the time spent on lighting maintenance."

Westinghouse recommendation: "To install Westinghouse Mercury Lighting."

Result: "Less than half as many fixtures to maintain and fewer lamps to replace, because mercury vapor produces more light per luminaire than any other lighting system."

This is only one case out of hundreds of "time-tested" installations. All show evidence that Westinghouse Mercury Lighting is a fast growing industry favorite. Investigate the complete line: 400, 1,000 and 3,000-watt units for either low or high-bay areas . . . open or closed fixtures for clean or dirty locations . . . high or low-voltage ballasts for any distribution system. Send for B-4727, "Westinghouse Lighting at Work" in every industrial area. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.



YOU CAN BE SURE.. IF IT'S  
**Westinghouse**

**LIGHTING DIVISION**  
Edgewater Park, Cleveland



# *When you figure*

ON USING

# *Steel City*



## **ELECTRICAL BOXES and CONDUIT FITTINGS**

*you can figure with a factor of safety*

Steel City Boxes and Fittings are not only designed to serve best the purpose for which they are intended, but careful inspection prevents any high-cost minutes of installation time being lost due to defects.

... and you can figure with the same factor of safety when conduit hanging or supporting is involved, if you use ...

## **STEEL CITY-KINDORF DEVICES**

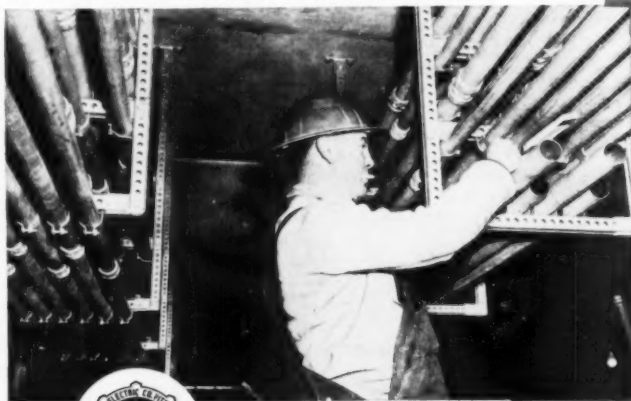
They are scientifically designed to work together in solving problems ...

FROM THE SIMPLEST



TO THE MOST COMPLEX

Write for descriptive catalogue



### **STEEL CITY**



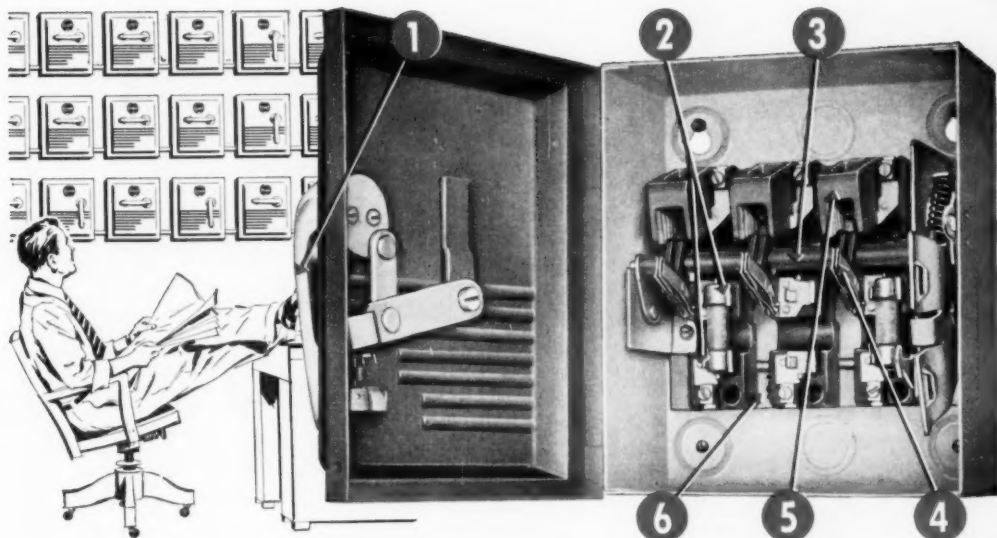
### **ELECTRIC CO.**

OUTLET BOXES AND COVERS

SWITCH AND FLOOR BOXES

JUNCTION BOXES, CONDUIT FITTINGS AND KINDORF DEVICES

PITTSBURGH 33, PA.



## MAINTENANCE? There's nothing to it with Federal Noark Front-Operated Safety Switches

AND THERE'S NEVER any doubt about the position of Federal Noark Front-Operated Safety Switches. Just one glance... even from across the room... shows you *positively* whether these switches are "on" or "off".

Besides that, they have accommodation for four padlocks; key mechanical parts can readily be replaced as a unit in the field; other special

features (described below) that assure coolest, safest operation and long, trouble free service life. Order Federal Noark Front-Operated Safety Switches, 30, 60, 100 amp., 230 and 575 volts, from your wholesaler, and write us for descriptive booklet.

Federal Electric Products Company, 50 Paris St., Newark 5, N. J.



**1**—When the big, rugged handle is vertical, the switch is "Off"... when horizontal, the switch is "On." No chance for question or uncertainty! What's more, front operation permits the close ganging important on many installations.



**2**—Pressure spring of the patented fuse holder is located in block under fuse where unaffected by fuse heat. High-pressure lever action assures minimum contact resistance: cool operation. No screws to forget to tighten; no springs near fuse to become annealed.



**3**—This is the only visible blade switch with the operating cross bar beneath the switch blades. The operator is thus safeguarded because the cross bar always forces open the contacting blades.

**4**—In these switches there are only two joints at each pole and both are under pressure. This is the coolest, most practical switch blade ever designed.

**5**—All 230v. Federal Noark Front-Operated Type A Safety Switches have arc mufflers. Patented Rolarc Arc Snuffers are used on all 575v. switches.

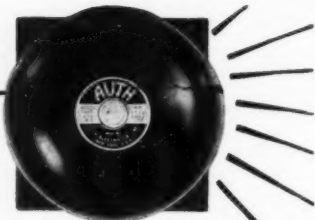
**6**—Switch mechanism of the Type "A" is mounted on a back plate and can be removed from box by only loosening the screws,

# FEDERAL NOARK®

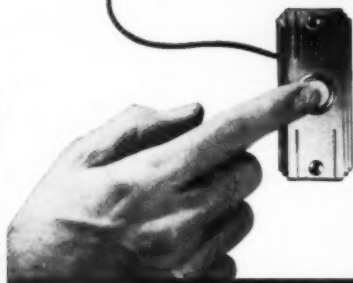
Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.



# Complete SIGNALING SYSTEMS

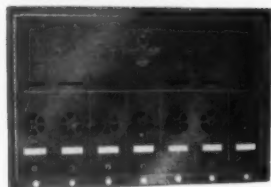


## FROM *One* RESPONSIBLE SOURCE



Whether it's a hospital or a school, a housing project or an industrial plant, Auth makes the signaling systems for it — complete! Protect your reputation by specifying reputable systems . . . Eliminate confusion . . . simplify your work . . . and save money for your client.

On your next commission place the responsibility for all signaling and communication equipment with Auth, a Company having more than half a century of experience in this field. You'll be glad you did.



### FOR HOUSING

U.S. Approved Mail Boxes; Doorbell Systems and Mechanical Door Chimes; Telephone and Fire Alarm Systems.



### FOR HOSPITALS

Nurses' Call, Doctors' Paging, and "In and Out" Register Systems; Clock, Telephone, Fire Alarm Systems; Night Lights.



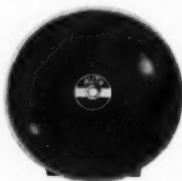
### FOR SCHOOLS

Clock, Program Bell, and Fire Alarm Systems; Telephone and Miscellaneous Signaling Systems.



### FOR OFFICES

Buzzer, Annunciator, and Clock Systems; Telephone, Fire Alarm, and Elevator Signaling Systems.



### FOR INDUSTRIAL PLANTS

Fire Alarm, Telephone, and Paging Systems; Clock and Program Bell Systems; Supervisory Annunciators.



### FOR COMMERCIAL HOUSES

Telephone, Clock, and Fire Alarm Systems; Buzzer, Annunciator, and Paging Systems.

**MANUFACTURERS OF**  
Electrical Signaling,  
Communication and  
Protective Equipment for  
Housing, Hospitals,  
Schools, Offices, Ships,  
and Industry.

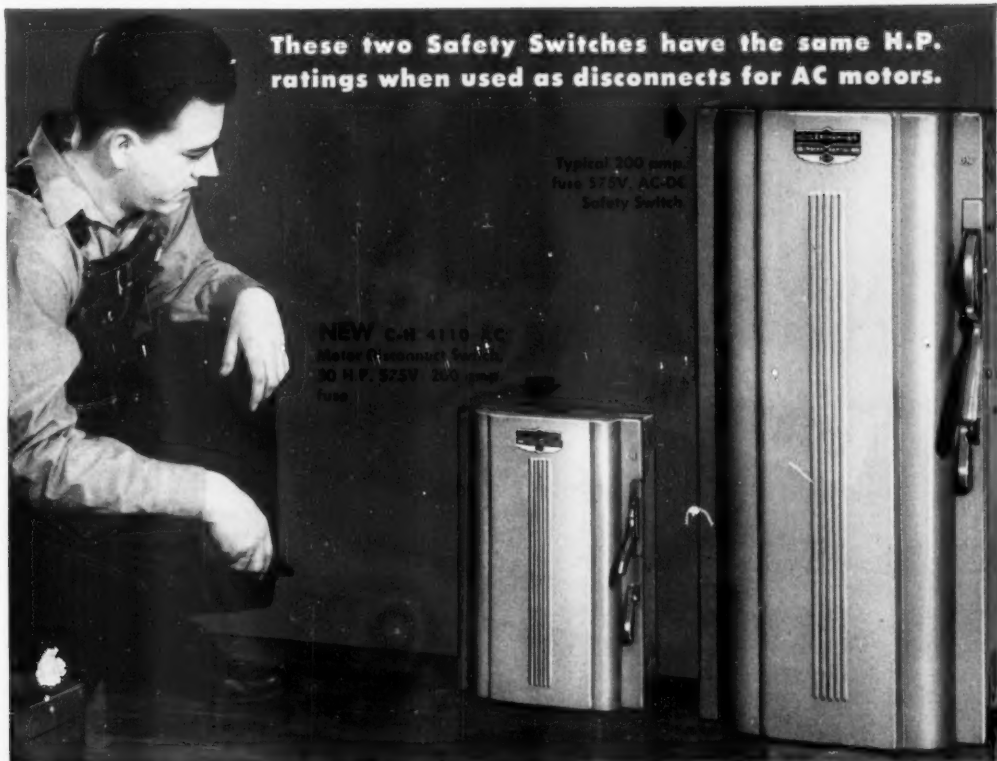


*Descriptive Literature upon Request  
Sales Representatives in Principal Cities*

COMPLETE SYSTEMS • ONE RESPONSIBILITY

**AUTH ELECTRIC COMPANY, INC.**

34-20 45th St., Long Island City 1, N.Y.



These two Safety Switches have the same H.P. ratings when used as disconnects for AC motors.

Typical 300 amp,  
fuse 175V, AC-DC  
Safety Switch

NEW C-H 4110 AC  
Motor (Horsepower) Switch,  
30 H.P., 575V, 250 amp,  
fuse

## Revolutionary New AC Motor-Circuit Safety Switches

matching motor control cases, size for size; matching performance, too

Up until now safety switches have invariably been much larger than the motor control with which they have been used. This has created difficult installation problems. Even when space was available, their bulk and weight made mounting difficult; and the much larger size of the safety switch in such close relation to an associated control enclosure has simply been all out of proportion to the latter. This detracted from the appearance of the complete installation. Cutler-Hammer engineering has ended all this as far as AC motors are concerned. The new and exclusively Cutler-Hammer Bulletin 4110 line of Horsepower Rated AC Motor-Circuit Safety Switches matches safety switch and motor control in size, convenience, and dependability. Available now in ratings from 3 H.P. to 30 H.P., 3 or 4 poles, for 230 Volts AC... and in ratings from 7½ H.P. to

50 H.P., 3 or 4 poles, for 575 Volts AC. Inspect these better switches now and see their many features. Front side operated. Quick make and break. Simple release cover-interlock. Provision for 3 padlocks in "OFF" and 1 padlock in "ON" positions. Unit pole construction. Non-welding butt type totally enclosed silver contacts. Silver plated current carrying parts. Positive-pressure type fuse clips. Solderless connectors. NEMA 1 enclosure. Complete switch assembly on panel removable for easy installation and wiring. Adequate and convenient knockouts. Cutler-Hammer quality and advanced engineering at no extra cost. These switches have no substitutes even remotely comparable. Your Cutler-Hammer Authorized Distributor can supply you. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.

Another  
CUTLER-HAMMER  
"FIRST"



Another  
CUTLER-HAMMER  
"EXCLUSIVE"

# NEW

## CURTIS INDUSTRIAL SERIES

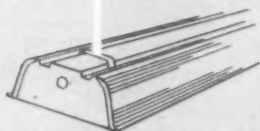


## CURTIS 6000 INDUSTRIAL SERIES

The New Curtis "Six Thousand" series is designed for Eye-Comfort® in industrial locations. The Luminaires illuminate the ceiling with an indirect component of 25% of the light output. Crosswise shielding of 35° is provided for the 75% direct component. The lighting units in this versatile line are available with Alzak Aluminum, Porcelain Enamel, or baked white "Fluracite" enamel removable side reflectors. Low cost efficient maintenance is provided by having side panels readily removable for cleaning. In addition there are no horizontal diffusing or reflecting surfaces to collect dust. There is a unit in this versatile line to accommodate all 4', 5' and 8' fluorescent lamps. The Curtis "Six-Thousand" series brings Appropriate Brightness Control Lighting to industrial areas.

Curtis "Tang Hangers" facilitate and cut installation cost as they allow flexibility in placement of hangers and permit by-passing of building construction obstacles such as beams, sprinkler heads, etc.

\*Pat. applied for.



**CURTIS**  
LIGHTING, INC.

6135 WEST 65TH STREET, CHICAGO 38, ILLINOIS



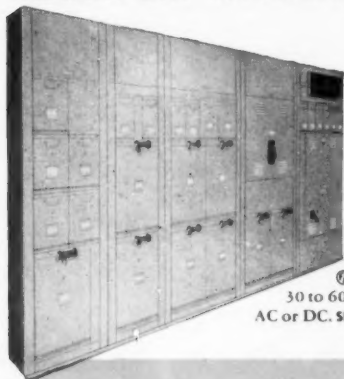
## MAXIMUM EFFICIENCY-DEPENDABILITY-AND ECONOMY

...that's what you get with

**Standardized**



## SWITCHBOARDS



Ⓢ KLAMP SWITCHFUZ  
30 to 600 amps, 250 volts  
AC or DC. SNUFARC 30 to 200  
amps, 600 vol.-s.

Standardized Ⓢ Switchboards are noted for their safety, efficiency, dependability and economy of operation.

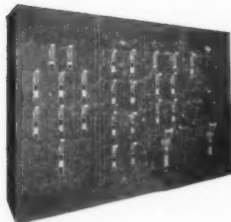
The result of more than 60 years of manufacturing experience, these sturdy, long-lasting and trouble-free power centers embody all the latest features in design and operating units to assure maximum service.

Standardized Ⓢ Switchboards are of three types—The Shutbrak, a safety-type switchboard designed for frequent operating use; the Klampswitchfuz, which features a dependable hinged type, pull-out switching unit for disconnect service on lighting and power circuits, and the Circuit Breaker, another safety type featuring the latest developments in automatic circuit protection for main and branch feeder circuits.

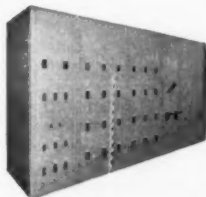
All are built from standardized, pre-assembled units. This flexible system of assembling complete sections and units into standardized enclosures not only provides all the advantages of "tailor-made" switchboards but affords substantial savings in cost.

All standardized Ⓢ Switchboards are factory-assembled and shipped ready for connection to main and branch circuit cables. Units can be arranged singly or grouped, because all sections readily fit together. Removable end walls permit the addition of sections on either side. The number and capacity of switches are supplied according to specifications.

Want to know more about these efficient, long-lasting power centers? Your nearest Ⓢ representative listed in Sweets, will be glad to give you complete information.



Ⓢ SHUTBRAK  
30 to 1200 amps, 250 volts  
AC or DC and 600 volts AC.



Ⓢ CIRCUIT BREAKER  
15 to 600 amps, 250 volts  
AC or DC; and 600 volts AC.  
For larger capacities air  
circuit breakers are used.

### Frank Adam Electric Co.

P. O. BOX 357 ST. LOUIS 13, MISSOURI

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE  
EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER



# Build Your Reputation by

## MEET THE BIG EXISTING DEMAND FOR *Interlocking Wiring Devices*

WITH THE NEW, IMPROVED



2-, 3- and 4-WIRE CAPS,  
CONNECTORS, PLUG BASES, MOTOR BASES,  
MOTOR PLUGS and FLUSH RECEPTACLES

*Grounding types are available . . . all receptacles and connectors can be used with either polarized or non-polarized caps. Despite the many improvements in design and construction, HART-LOCK units can, if necessary, be interchanged with older types of interlocking devices.*

Manufactured by THE ARROW-HART & HEGEMAN ELECTRIC CO.

20 AMPS

125 VOLTS, A.C.-D.C.

10 AMPS

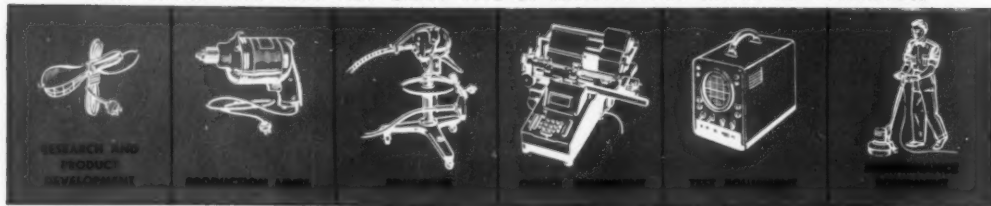
375 VOLTS, A.C.

*Positive Action*

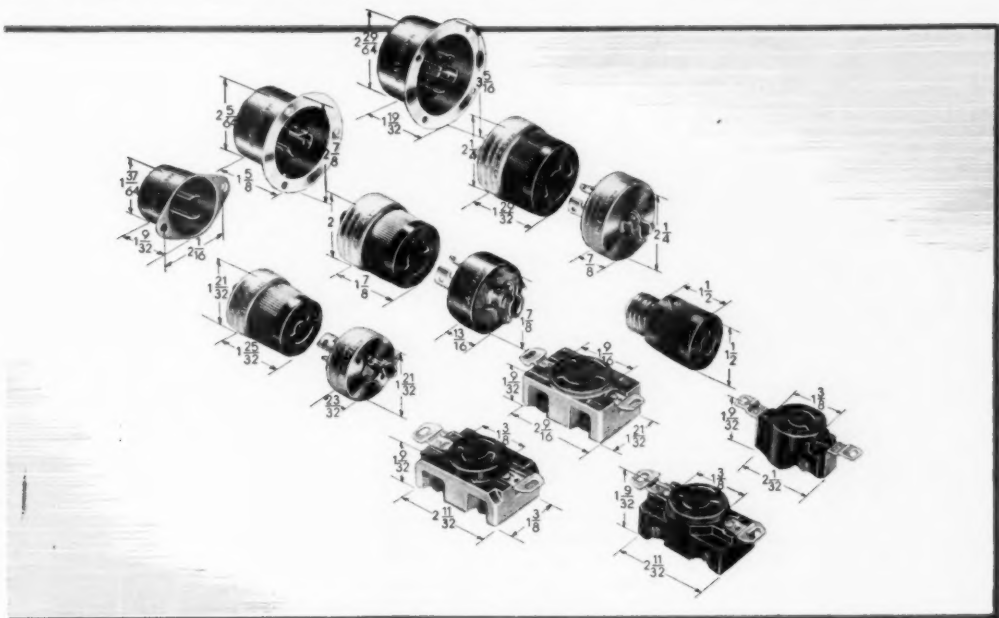


*Wherever Separable Connections are needed*

**HART-LOCK** • PREVENTS UNINTENTIONAL DISCONNECTS FROM ANY ACCIDENTAL CAUSE • INCREASES SAFETY . . . ELIMINATES WASTE BY ASSURING A CONSTANT POWER SUPPLY • OFFERS YOU—AND YOUR CUSTOMERS—MORE IMPORTANT ADVANTAGES THAN ANY OTHER TYPE OF INTERLOCKING DEVICE NOW AVAILABLE



# USING THE BEST

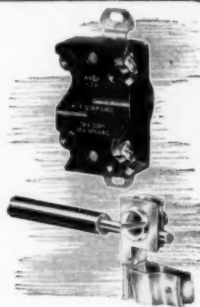


## Check these Features

**OPTIONAL WIRING**— Back-wired and Side-wired receptacles are quicker and easier to install. The strong, secure connections are neater and safer with no exposed wire ends. A handy, Wire Strip Gage on the back plate gives the exactly correct length for both back and side wiring.

**EXCLUSIVE ONE-PIECE "CONTROLLED-TENSION" INNER CONTACTS**— For greater electrical efficiency, minimum resistance, low loss. Heavy bronze U-type construction with single staking to mounting bracket is stronger . . . lasts longer.

**HEAVY, RUGGED, HIGH QUALITY CONSTRUCTION**— Body is of the best commercial Bakelite for use . . . porcelain is available for applications requiring high heat resistance. All conducting parts are heavy brass or bronze; ferrous metal parts are heavily zinc plated to resist corrosion.



## Ask your local Electrical Distributor

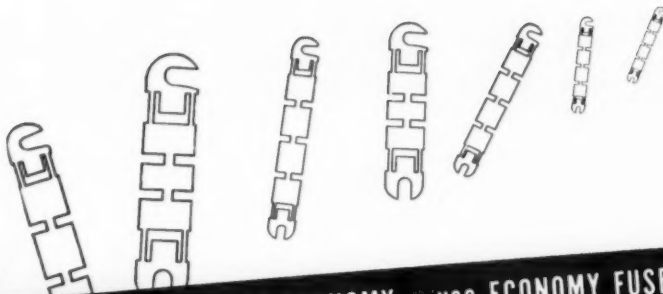
**TO SHOW YOU  
THE NEW HART-LOCK**

Logical source for the newer, better HART-LOCK — and all the other high quality wiring devices in our complete line — is your local electrical distributor. He is familiar with your needs and stocks the equipment and supplies you call for. You are assured of prompt, personalized service. Next time you need to order interlocking devices, stop in or phone your local distributor — and ask for HART-LOCK.

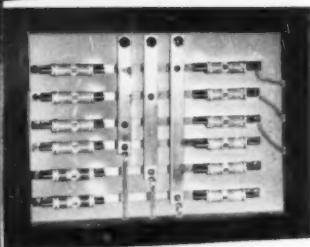


**THE ARROW-HART & HEGEMAN ELECTRIC COMPANY**  
1706 LAUREL STREET  
**HARTFORD 6, CONNECTICUT**

Branches in: BOSTON, CHICAGO, DALLAS, DENVER, DETROIT, LOS ANGELES, NEW YORK, PHILADELPHIA, SAN FRANCISCO, SYRACUSE. In Canada: ARROW-HART & HEGEMAN (CANADA) LTD., MT. DENNIS, TORONTO 15, ONTARIO.



for FUSE ECONOMY... use ECONOMY FUSES



YOU SAVE  
3 WAYS!

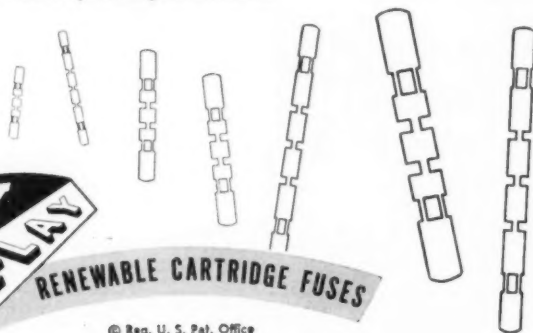
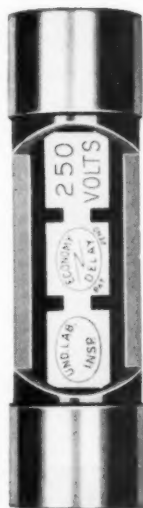
**FIRST**—with "ECONOMY DELAY" Renewable Fuses you save money every time you have a current "blow". Simply remove the blown link and replace it at the cost of only a few cents with a new, "ECONOMY DELAY" Renewal Link in the same cartridge.

**SECOND**—you save because of the short time required to make this replacement—and time is money.

**THIRD**—you save by reducing "down time" on machines—because an inexpensive carton of Economy Fuse Renewal Links kept on hand 24 hours a day, answers fuse renewal requirements immediately.

Your Electrical Wholesaler has "ECONOMY DELAY" Renewable Fuses and Renewal Links in stock.

Ask for the Economy Catalog and Price List.



**ECONOMY  
DELAY**  
RENEWABLE CARTRIDGE FUSES

© Reg. U. S. Pat. Office

ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPRESENTATIVES IN ALL PRINCIPAL CITIES



**Your logical  
SOURCE**  
—for all tape  
requirements!

Good workmanship in wiring calls for good materials. Make certain of tape quality by using the tape that's made with 30 years experience behind it!

## ACCURATE Plastic Tape



Offers a bulk-reducing combination of thin caliper, good mechanical and dielectric strength. Recommended for use wherever plastic tape is practical.

# Electrical men everywhere agree on — **ACCURATE** YOUR BEST BUY IN ELECTRICAL **TAPES** ...for every **INSULATING** need!



### ACCURATE RUBBER TAPE

Features high elasticity, excellent cohesion, high dielectric and super aging qualities. Available in Standard and A.S.T.M.-A.A.R. grades.



### ACCURATE FRICTION TAPE

High grade rubber carefully compounded with finest cotton base provides maximum mechanical protection for every wrap. Made in Standard and A.S.T.M. grades.

**...no finer tapes at any price!**

For big wiring jobs or small, Accurate is the choice for positive tape protection. Both friction and rubber are strong, pliable, easy to apply. Accurate tapes make accurate wraps—pull tight and clean over irregular surfaces. When you order tape, mention Accurate by name. It's the one sure way to complete tape satisfaction. For a complete guide to tape selection and tape buying, ask for the new Accurate Data Folder. Accurate Mfg. Company, Garfield, New Jersey—address inquiries to Dept. AA.



MORE THAN A QUARTER CENTURY OF TAPE SPECIALIZATION



# Texas construction firm by setting

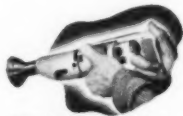


New 18-story office building for the Prudential Insurance Company of America, where Straus-Frank Co. used Remington Stud Drivers for fastening air ducts to concrete ceilings.

*It's fast, easy and safe to operate  
the Remington Stud Driver*



Simply hand-assemble stud and power cartridge, load as a unit in easy-to-open Remington Stud Driver, and close.



Press loaded Stud Driver firmly against surface, depress safety lever and pull trigger. Explosive charge imbeds stud solidly.

## LOOK AT ALL THESE FEATURES

**COMPACT AND PORTABLE**—Weighs only 5½ pounds, ideal for overhead work in inaccessible places.

**SPEED**—One man can set as high as 5 studs per minute on repetitive work at depths up to 2¾ inches, depending on material.

**ELIMINATES INVESTMENT** in outside power—completely self-powered.

**FOUR WAYS SAFE**—Plainly visible red dot indicator shows when Stud Driver is cocked; safety lever must be depressed before and during squeezing of main trigger; permanently attached safety shield must be compressed against work before Stud Driver will operate. If tilted at more than a slight angle, Stud Driver will not fire. Slight recoil. Low noise level.

**RUGGED**—All working parts of the Stud Driver are made of selected steels, cased in a strong aluminum-alloy housing. Lining of safety shield is a solid block of tough, resilient Du Pont neoprene.

**PRICE** for Model 450 Remington Stud Driver, complete in rugged steel carrying case—only \$119.50.



# saves over \$8,000 fastening studs with

NEW Cartridge-Powered Model 450

# REMINGTON STUD DRIVER

Revolutionary new tool sets studs  
in seconds... and does it safely!



Construction job speeded at a substantial reduction in labor costs! That's the report from Straus-Frank Co., Houston, Texas, whose contract division used Remington Stud Drivers on a recent building project. In setting fastening studs for overhead air ducts, the Stud Drivers outproduced older methods eight to one... averaged 50 studs per hour, including down time!

Completely self-powered, the Remington Stud Driver needs no outside power source or extra equipment. The hinged construction of this lightweight fastening tool permits easy one-step loading—without the time loss of handling separate parts. Workmen like the Stud Driver's simple operation and safety features... Contractors like its lightning speed in firmly fastening steel or wood sec-

tions to concrete or steel. Studs have pull-out resistance as high as two tons!

The Model 450 Remington Stud Driver is made by Remington Arms Company, Inc., America's oldest and foremost sporting arms manufacturer. To obtain detailed information on this time- and money-saving tool, and for the name of your nearest distributor, mail the coupon below.

Speed all these jobs... with Remington studs designed for the job!

1. Fastening electrical fittings to concrete, steel and brick.
2. Hanging steel sash to concrete and brick.
3. Anchoring stadium and theatre seats to concrete.



Only Remington studs are identified by this target trademark on the head.

#### STANDARD HEAD



4. Fastening wood to steel.
5. Anchoring wood plates to concrete floors and ceilings.
6. Hanging steel radiator housings to concrete or brick.

#### BREAK-OFF HEAD



#### INTERNAL THREAD



#### EXTERNAL THREAD



"If It's Remington—It's Right!"

# Remington



Remington Arms Company, Inc.  
Industrial Sales Division, Dept. CE  
939 Barnum Ave., Bridgeport 2, Connecticut

I am interested in obtaining detailed information on the Model 450 Remington Stud Driver.

Name \_\_\_\_\_  
Firm \_\_\_\_\_  
Position \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

*The lighting every young American deserves  
is here at last!*



*Yesterday's illuminations  
are now superseded by the modern-dispelling  
ceiling of comfort-brightness.*



**NOW! Here, at last, is the  
COMFORT-BRIGHTNESS  
BALANCE**

long sought by Educators



**no forest of fixtures...no annoying glare  
...no disturbing brightness...**

The dream of every educator...*more useable illumination with greatly improved comfort-brightness balance*—is now brought to realization through Benjamin's newest engineering advancement...the "Grid-Lite" Lighting System.

"Grid-Lite", through its translucent louvers, literally creates an entire ceiling of light... yet without involving excessive cost.

The translucent louver not only provides proper shielding...but imparts a unique quality to the light that makes for ease of seeing...a complete unawareness of high level lighting...a sense of comfort which promotes attention and concentration.

"Grid-Lite" triumphs over cost. It puts the entire system into a single package...ready to install. A descriptive bulletin is ready for your inquiry. Write Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois.

*Latest Engineering Achievement by* **BENJAMIN**

**"Grid-Lite"**  
A COMPLETE LIGHTING SYSTEM IN A PACKAGE  
READY FOR ECONOMICAL INSTALLATION

*sold exclusively through electrical distributors*

# Washington Report

---

**Further relaxation of controls** is in sight, but not complete decontrol. Construction regulations will be eased July 1, steel will probably be decontrolled by year's end, and aluminum early next year—barring unpredictable upsets in demand-supply balances by strikes, more crises, or otherwise. But top planners in DPA and NPA want controls machinery kept in working order to complete the three-year defense mobilization program originally planned, now at about its midway point.

Price-wage controls will be relaxed, but how much depends on Congress. Price ceiling suspensions to date have been experimental, and new policy is to remove ceilings where prices are consistently below OPS maximums. This is political, an overture to a cool Congress which now wants price-wage controls limited to next March 31 or earlier, and to business which is fed up with what it considers unnecessary bureaucratic control.

Some type of control on copper will be needed at least until the end of 1953, mobilizers now say, at which time new additions to the annual copper supply will become available. CMP now seems the best bet, which might be made "open end" as supply begins to balance demand.

**Copper allocations** for June for copper processing and fabricating industries were about the same as for May, however regular commercial sources had to be supplemented by withdrawals from other sources due to low June imports from Chile and to earlier work stoppages.

**Electric equipment expansion goals** have been raised to conform to the new expansion goals for electric energy, recently approved to meet rapidly increasing demands of the defense program and to maintain simultaneously ample electric power for civilian uses. These goals include power and distribution transformers, generators, condensers, steam boilers and turbines. Also included are expansion of facilities for these equipment producers.

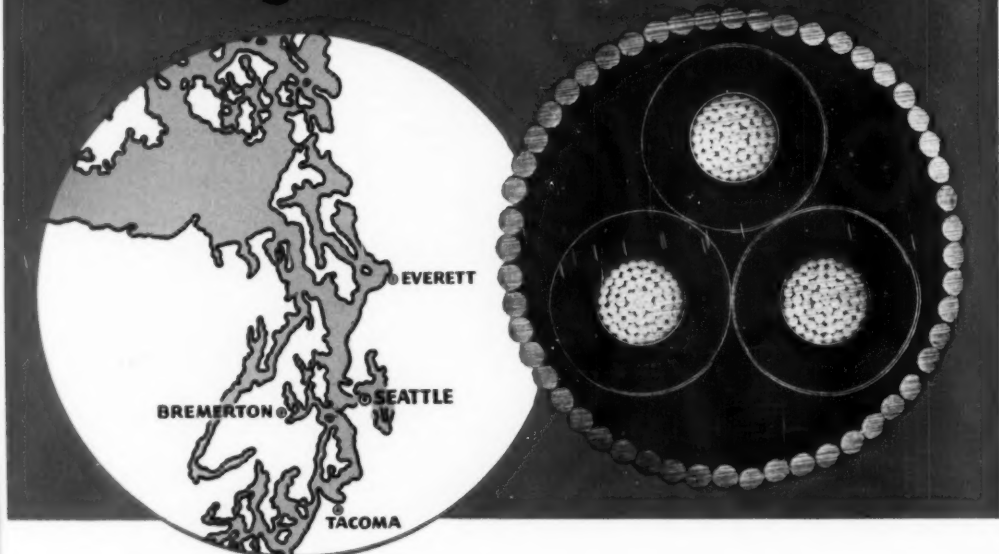
**Additional manufacturing capacity** for power switchgear and circuit breakers is not needed in that industry, its IAC members recently told NPA. But in view of the power expansion program through 1954, NPA has named a task force to further study demand vs. capacity. Industry members also said several companies are studying substitution of aluminum for copper for bus bars and other electrical conductors, and that some are already using aluminum for these purposes.

**Construction regulations will be relaxed further** beginning July 1, to take up the slack brought about by the reduction of the defense construction program during the last half of the year. Amendment of CMP Reg. 6 will provide: 1) Revocation of ban on recreation construction and permission to self-authorize per quarter for this type of construction—5 tons of carbon steel, 200 pounds of copper, 250 pounds of aluminum; 2) Increased amounts of materials which may be self-authorized for commercial construction, to—25 tons of carbon steel, 750 pounds of copper, 1,000 pounds of aluminum; 3) Aluminum for all types of construction; and other miscellaneous relaxations.

**Housing Construction Order M-100** will also be amended July 1 to allow self-authorization of 1,500 pounds of structural shapes and 250 pounds of aluminum in addition to present allowance for steel and copper.

**Commercial construction approvals** during April included controlled materials allotments for 1,069 commercial, religious, entertainment and municipal projects with an estimated cost of more than \$337-million. A total of 249 retail stores with an estimated cost of \$144-million led the list in value with 109 office and loft buildings at \$34-million next.

# 19 high voltage OKONITE SUBMARINE CABLE CROSSINGS in Puget Sound area alone



## 57 CIRCUIT MILES INSTALLED BY FIVE UTILITIES PROVE OKONITE CABLES CAN TAKE IT

Date	Footage	Location
1926	20,700 ft.	President Point
1926	20,700 ft.	President Point
1926	15,000 ft.	Lake Union
1930	15,000 ft.	Fox Island
1931	16,000 ft.	Vashon Island
1931	25,000 ft.	Lake Washington
1931	15,000 ft.	Mercer Island
1933	10,000 ft.	Hood's Canal
1935	23,000 ft.	Lake Union
1936	10,000 ft.	McNeill Island
1939	8,500 ft.	Hood's Canal
1939	2,000 ft.	Lake Union
1940	22,000 ft.	President Point
1942	5,000 ft.	Bainbridge Island
1945	22,000 ft.	President Point
1950	16,000 ft.	Vashon Island
1951	39,200 ft.	San Juan Islands (2)
1951	12,000 ft.	San Juan Islands
	297,100 ft.	

When you specify Okonite rubber-insulated cables—for *any* purpose above or underground—you are sure of dependable year-in year-out performance. For you get electrical insulation designed for the job and a covering engineered to protect that insulation during its full life span under the specified operation conditions. You also get the advantage of Okonite's proved manufacturing techniques, such as insulation applied by the strip process and vulcanization in a metal mold. These are your assurance of long-lived, trouble-free electrical circuits.

Installations in all voltage ranges and under the most exacting conditions are proving every day that Okonite is your most economical cable buy. The Okonite Company, Passaic, N. J.

*The best cable is your best policy*



# OKONITE



*insulated wires and cables*



# JUNE . . . . at a Glance

## Aluminum Case Study

Shortage of copper turned the feeder design of a new Abraham and Straus department store toward aluminum for main distribution. The adaptation of aluminum required special consideration as to wire sizes, conduit sizes and terminal techniques. The resulting installation is a timely case study in a field where practical job experience is still very much needed. See "Aluminum Feeders in a Modern Department Store" by L. V. Burger and A. E. Blanchard beginning on page 65.

## Addendum

On page 77 of the May issue in the text of "Wiring Pittsburgh's Aluminum Skyscraper," a listing of several major equipment suppliers notes ITE as the manufacturer of, among other items, "breakers" used on the project. In addition to the main and feeder circuit breakers supplied by ITE, however, overcurrent protection in the branch panelboards is provided by Heine-mann fully magnetic type circuit breakers.

## Specifications

Next month's issue, July, will be devoted to the fifth revision of the Master Electrical Specification. Originally developed in 1936, this basic specification has been revised and enlarged every few years to encompass more of the growing scope and detail of the

electrical construction industry. The 1952 revision is the most extensive to date. Many of the sections have been completely revised and others greatly expanded. Watch for the big July Specification Issue.

## Maintenance Tools

The right assortment of tools and the right instruments are essential to efficient electrical maintenance schedules. Walter J. Prise, of the Maintenance Company of New York, out of wide practical experience, outlines the tool and instrument requirements for trouble-shooting and repair in "Maintenance Tools and Instruments," page 78.

## Basic Rules

Good wiring design is a matter of such basic importance to electrical construction progress that the series beginning in this issue "Basic Rules for Industrial Wiring Design," page 86, hardly needs an introduction here. This series was carefully developed to the editor's specifications (which means that it was drawn up to give the maximum useful data for our readers) from one of the largest and most comprehensive sources we have seen in some years, the new Anaconda catalog and data book. Frank Aime, fresh from editing this monumental work, was prevailed upon to write the series drawing upon its rich resources of practical data for these articles.

## DATES AHEAD

**National Association of Electrical Distributors**—Annual convention, Atlantic City, N. J., June 9-13.

**National Fire Protection Association**—Annual meeting, Hotel Statler, New York, N. Y., June 9-13.

**Illuminating Engineering Society**—Northeastern Regional Conference, Hotel Preston, Swampscott, Mass., June 19-20.

**Illinois Chapter, International Association of Electrical Inspectors**—Summer meeting, Hotel Fort Armstrong, Rock Island, Ill., June 19-20.

**New York State Association of Electrical Contractors and Dealers, Inc.**—Saranac Inn, Saranac, N. Y., June 29-July 7.

**Illuminating Engineering Society**—National Technical Conference, Edgewater Beach Hotel, Chicago, Ill., September 8-13.

**International Association of Electrical Inspectors**—Northwestern Section, Twin Falls, Idaho, September 11-13; Southwestern Section, California Hotel, Fresno, Calif., September 18-20; Eastern Section, Hotel Statler, Washington, D. C., October 1-3; Western Section, Hotel Hollenden, Cleveland, Ohio, October 6-8; Southern Section, Hermitage Hotel, Nashville, Tenn., October 13-15.

**National Electronics Conference**—8th annual conference, Sherman Hotel, Chicago, Ill., September 29-Oct. 1.

**National Electrical Contractors Association**—Annual convention, Hotel Morrison, Chicago, Ill., October 5-10.

**Electrical Industries Show**—Sponsored by the Eastern Electrical Wholesalers Association, 165th Regiment Armory, New York, N. Y., October 14-17.

**National Farm Electrification Conference**—Hotel Statler, Detroit, Mich., October 20-21.

**National Industrial Service Association**—Southeastern Chapter meeting, Miami, Fla., Oct. 24 and 25.

**National Electrical Manufacturers Association**—Haddon Hall Hotel, Atlantic City, N. J., Nov. 10-13.



**DIRECT BURIAL**



**OVERHEAD**



**IN DUCTS**

## Low-cost way to hit the **high** and **low** spots— use All-Purpose **DURASHEATH**

**DURABLE DURASHEATH**® can be used for every type of power and lighting application up to 15kv\*\*. The most important fact about this all-purpose cable is that it may be run *overhead*, *buried directly underground* and run *in ducts* in one continuous length. Expensive splicing is avoided. Durasheath eliminates sheath electrolysis. It effectively resists condensation, weathering, sunlight, organic decay, abrasion and mechanical injury.

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lasts longer. Its special neoprene jacket is tough enough to stand up to every natural enemy of cable life. It simplifies stock inventory. You need purchase only *one* cable—versatile Durasheath—to meet every electrical distribution requirement.

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†When ordered to CAA Specifications L-824.

\*\*for voltages over 5kv consultation with Anaconda Engineers is recommended.

## **Heat Pumps**

**APPEARANCE OF NEW** commercial heat pumps on the market in recent months may well mark the beginning of a new era of electrical development in this country. The device promises winter space heating at energy costs comparable with fuels, plus summer cooling from the same equipment. Controls handle the operation and changeover automatically.

**HEAT PUMPS ARE SUBSTANTIALLY** the same as refrigerators or air conditioners, but designed to use either end of the refrigeration cycle. The cold evaporator coil absorbs heat from the air for summer cooling; the hot condenser coil gives up heat to the air for winter heating.

**WHILE THE PRINCIPLES** are simple enough, the practical application presents many design problems. Something must be cooled. Heat energy must be extracted from earth, water or air as the most abundant sources of stored heat. And each source presents its own practical engineering problem in the extraction of the heat energy.

**HEAT PUMPS** look relatively expensive in installed cost when compared with conventional automatic heating plants. But when compared more logically with heating plants plus full summer air conditioning, the heat pump is not far out of line. The rapid growth of summer air conditioning tends to support optimistic views of the potential market opportunity.

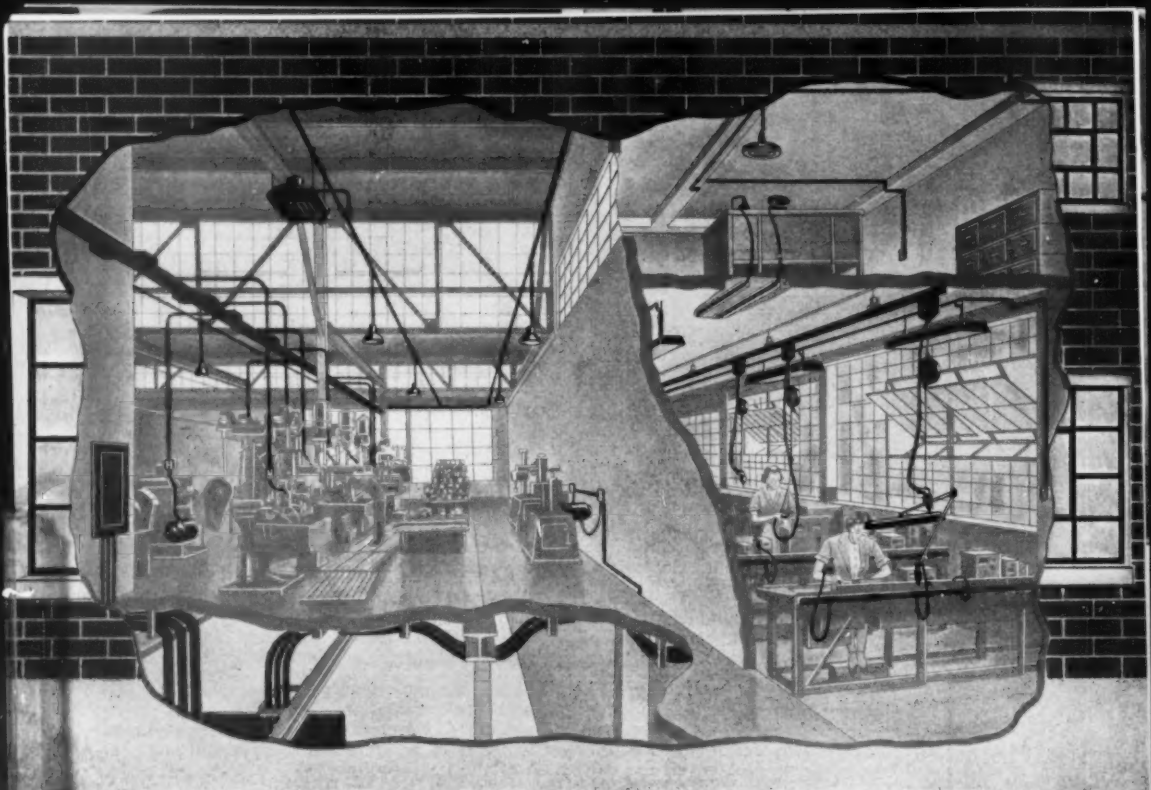
**AT THE POWER LEVEL,** heat pumps require a substantial fraction of the Btu output in kilowatt hours input. Load requirements follow the degree-day curve which usually peaks in early February. Mechanical in operation, they take motor drives with all that means to distribution systems in voltage fluctuation and power factor. To the utility engineer the load presented by the heat pump is only a little less troublesome than the load presented by resistance heating.

**PRESENT UTILITY RATES** are based on experience with present load factors. Any large new load on the degree-day curve will inevitably reduce the ratio of kilowatt hours to system capacity. Any type of electric heating, heat pump or otherwise, is likely to be less than attractive to utilities on existing rate schedules. The obvious advantage of polyphase operation of heat pumps on many lines now adequately served single phase is another headache. But the electric power industry has long thrived on such problems.

**IN WIRING,** heat pumps take, in most of the Temperate Zone, substantially more than air conditioning requirements. Service entrances, feeders, motor circuits and associated controls are large as compared with ordinary light and power requirements. It is the next step toward providing all of the light, heat and power requirements through the electric wiring system.

**IT IS A LONG AND DIFFICULT** commercial road between the introduction of a new engineering product and its wide acceptance and use. The heat pump shows great promise. It is a sound and logical target for projecting future electrical wiring requirements.

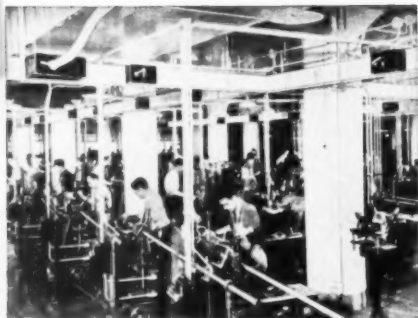
*Wm. T. Stuart*



**A COMPLETE WIRING SUPPLY SERVICE.** Your near-by Graybar office or warehouse offers a unique supply service covering electrical construction materials for industrial wiring projects of all types.

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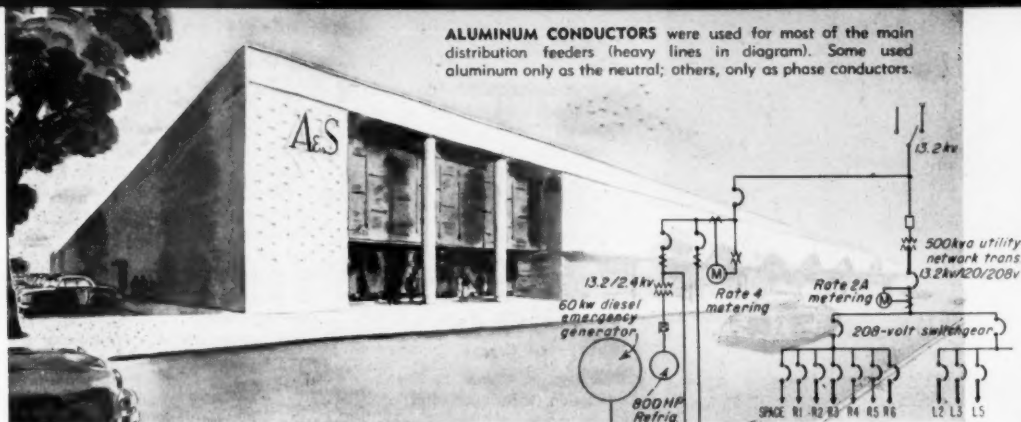
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**ALUMINUM CONDUCTORS** were used for most of the main distribution feeders (heavy lines in diagram). Some used aluminum only as the neutral; others, only as phase conductors.

# ALUMINUM FEEDERS

## In a Modern Department Store

How engineered installation techniques cut through the fog of difficulties surrounding a large scale installation of aluminum main distribution feeders.

By **Louis V. Burger and Albert E. Blanchard**

Engineer, Johnson Electrical Corp.,

Engineer, Burndy Engineering Co., Inc.

**I**N the recently completed, multi-million dollar Abraham & Straus Department Store, Hempstead, Long Island, N. Y., aluminum cable was used for the main distribution feeders in an extensive electrical design. On this job, careful consideration was given to the special electrical characteristics of aluminum conductor. Now, after two months of operation, the completely satisfactory results in this installation can be attributed in large part to the engineered techniques used by the electrical contractor, Johnson Electrical Corp., New York, N. Y., on all aluminum connections.

The Austin Company, Engineers and Builders, New York, N. Y., was responsible for the electrical design in this ultra-modern, three-story, completely air conditioned building of 236,000 square feet, the largest suburban department store project in the Northeast. Although the original plans called for all copper feeders, the critical shortage of copper forced the substitution of aluminum for the main distribution feeders.

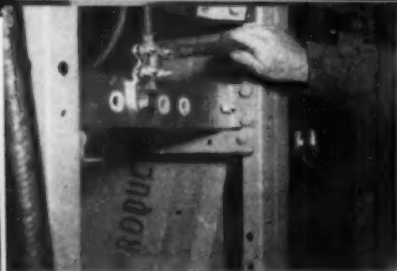
This change to aluminum feeders presented a host of problems to all concerned with the installation. Design computations of wiring capacity had to be altered on the basis of the reduced current-carrying capacity of aluminum. Fortunately, calculations allowed the use of the conduit which had already been installed for copper. It was found that the necessary size of aluminum conductors would require only 3% more space in the conduit than the copper cable originally scheduled. But the solutions to these and similar problems involved little more than a reshuffle of formulae to account for the 84%-of-copper conductivity of aluminum. It soon became obvious that the major consideration was the method of terminating and splicing the aluminum feeder runs to eliminate the poor electrical characteristics of aluminum connections.

That the connection problem was the heart of this job is readily evident from a quick look at the extensive electrical system as it now serves the building. Electric power enters the

building at 13.2 kv, 3-phase, from the utility substation. At the service equipment in the basement of the building, two metering rates prevail: one for the 13.2 kv primary service to the owner's distribution transformers; the other for a 208-volt secondary service from a 500 kva utility network transformer located in the basement and fed by the incoming 13.2 kv line. A 1000 kva transformer steps the primary service to 2.4 kv and feeds an 800 hp refrigeration compressor. The owner's distribution transformers step the 13.2 kv down to 120/208-volts.

Distribution feeders emanate from secondary switchgear on both services. From the 208-volt switchgear on the utility secondary service, feeders are run to lighting panels, receptacle panels and pull boxes. From the switchgear on the secondary side of the owner's distribution transformers, power and lighting feeders run to the air conditioning room load center, fan rooms, elevators, escalator power panel and lighting panels. Emergency

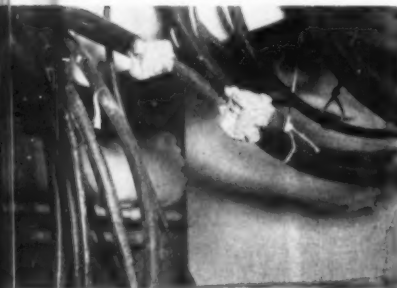




**CABLE TERMINAL** of suitably plated cast copper alloy is used here to connect 600 MCM aluminum cable to copper bus in switchgear.



**CABLE SPLICES** in ceiling box are wound with plastic tape before rubber taping, to prevent softening of the rubber tape by the Penetrox compound.



**BOLTED CONNECTORS** were allowed to stand 24 hours after installation to allow initial set due to "cold flow" of aluminum under pressure.



**FINISHED JOINTS** in pull box are tightly wound with rubber tape to insulate against air and moisture, thereby reducing the threat of corrosion.

light and power is provided by a 60 kw Diesel emergency generator through a 300 ampere electrically operated automatic transfer switch.

Most of the feeders have all aluminum conductors, 3-phase, 3-wire and 4-wire. The others have either all copper conductors, copper phase conductors with aluminum neutral, or aluminum phase conductors with copper neutral. All of the aluminum conductors are 300 MCM or larger.

#### Copper

The use of copper conductors in combination with aluminum conductors in some of the feeders was dictated by the economics of the situation. Although copper cable was not available for even a considerable part of the installation, a good quantity was on hand. When it was found that the long, 280 and 300 feet, lengths of most of the conductors left many short lengths at the ends of cable reels, a way was sought to utilize these short lengths. The available copper offered a satisfactory and economical solution. Lengths of copper cable were matched with the odd short lengths of aluminum for short feeder runs from the switchgear to some of the pull boxes and from some pull boxes to lighting panels.

The scope of this installation, therefore, necessitated careful regard for the cumulative effects of the special electrical characteristics of aluminum. The high electrical resistance of the oxide coating on aluminum had to be reduced to make satisfactory electrical contacts. Where aluminum and copper conductors were spliced or where aluminum was connected to copper, the galvanic corrosion due to contact between dissimilar metals had to be eliminated. And tight mechanical connections had to be carefully considered because of the "cold flow" effect in aluminum under pressure.

As a result of much study of the problem, it was finally decided to use two types of connectors for the applications involved. Both of these connectors, listed by the Underwriters' Laboratories, were constructed of high conductivity cast copper alloy and were suitably plated for use on either copper or aluminum, or combinations of both. A total of 350 clamp-type bolted connectors were used for splicing cables in pull boxes and on switch panels. Ninety clamp-type bolted cable terminals were used for taps on copper bus in the switchgear, and on motors and starters in the compressor room and fan rooms.

The actual work of installation

posed a unique problem for the contractor. Because of the magnitude of the job and the importance of proper connection methods, the electricians on the job had to be carefully briefed on the use of the connectors and on other factors involved in handling aluminum. For the most part, the installation crew was totally unfamiliar with the working procedure. To meet this situation, the details of sound electrical and mechanical connections of aluminum were presented to the resident engineer.

Preparation of the cable itself was the first step in the connection procedure. A coating of an oxide-cutting and corrosion-inhibiting compound, Penetrox A, was applied to the bare cable ends. Under this air-sealing compound, the cable ends were scratch-brushed with a wire brush to break the oxide layer. The cable was again coated with the compound. Then the connectors were installed and the bolts tightened. All of the Penetrox compound was then carefully removed.

#### Cold flow

The tendency of aluminum to "cold flow" under pressure was also carefully checked. To compensate for any initial "set" in the connection, the installed connectors were allowed to stand for 24 hours and were then retightened. Because of the low unit pressure of contact between the conductor and the large contact area of the connector, only one-third of the connectors had to be retightened.

After being retightened, each connector was thoroughly taped. Because the Penetrox would have a tendency to soften the first few layers of rubber tape on contact, a pre-taping was made with two layers of plastic tape which is inert to the compound. The rubber tape was then applied. Taping was made strong and tight on all connections to assure maximum insulation against air and moisture. The possibility of galvanic corrosion was thereby greatly reduced.

General handling of the aluminum cable, pulling in conduit, etc., was not particularly troublesome. The necessity for using the Penetrox compound was inconvenient at times; however, the light weight of aluminum was a distinct handling advantage.

Complete satisfaction with the results of this installation are clearly expressed by all concerned. And under the present heavy electrical load, the system capacity still has plenty to spare for future requirements. That sound engineering can make aluminum a serviceable alternate for copper is well attested by this installation.

## Distribution of Labor Charges to Material Items

By Ray Ashley

Research and Consulting Engineer  
Chicago, Illinois**QUESTION:** In good estimating practice, is labor always charged against the item on which it is performed?**ANSWER:** No.**DISCUSSION:** For the purpose of accurate estimating and the preparation of true labor units, the following rule must be adhered to:*Labor must be charged against the item occasioning it and not necessarily to the item on which it is performed.*

An elbow installed in a run of conduit, requires measuring, cutting, and threading a nipple. The work is performed on conduit, but occasioned by the presence of the elbow. The elbow must be charged with this labor.

The accompanying Table illustrates how labor actually used on conduit and wire, belongs in the outlet box labor unit. Under heading "I. Time Studies (roughing)", is an item "Thread Pipe" with a time listing of 8 minutes. Under heading "II. Time Studies (finishing)" is an item of "Poling Up," which requires 4.5 minutes. This makes a total of 12.5 minutes (8+4.5) of labor which was performed on conduit and wire. However, this 12.5 minutes was included in the labor unit because it was occasioned by the installation of the outlet box. If the outlet box were omitted, the nipple and poling-up would not be required.

The final adjusted ceiling outlet unit for the particular job (see item 5) was 32 minutes (.533 hrs.). Without the 12.5 minutes (conduit and wire labor) the unit would have been 19.5 minutes or .325 hours.

With a  $\frac{1}{2}$ -in. conduit labor unit of 4 hrs. per 100 ft., the correct estimate for installing 100 ft. of  $\frac{1}{2}$ -in. conduit and four ceiling outlets would be:  
4 boxes at 0.533 hrs. ea. . . . 2.132 hrs.  
100 ft.  $\frac{1}{2}$  in. cond. at 4 hrs./100 ft. . . . . 4.0 hrs.

Total . . . . . 6.132 hrs.

A similar total can be arrived at by using the 0.325 unit (the correct unit less the nipple and poling-up labor) and an excessive unit for conduit labor.  
4 boxes at 0.325 ea. . . . . 1.3 hrs.  
100 ft.  $\frac{1}{2}$  in. cond. at 5 hrs./100 ft. . . . . 5.0 hrs.

Total . . . . . 6.3 hrs.

The figures used in the latter illustration are wrong, yet for the particular combination of outlet box and conduit quantities, the estimated time is approximately correct. For any other combination of quantities the final figure would be either too low or too high depending on the ratio of box labor to conduit labor.

We will consider two more estimates, both for an installation of ten ceiling outlet boxes and 100 ft. of  $\frac{1}{2}$ -in. The correct estimate would be:10 boxes at 0.53 hrs. ea. . . . . 5.3 hrs.  
100 ft.  $\frac{1}{2}$  in. cond. at 4 hrs./100 ft. . . . . 4.0 hrs.  
Total . . . . . 9.3 hrs.

Using the figures resulting from the incorrect distribution of labor, the estimate would be:

10 boxes at 0.325 hrs. ea. . . . 3.25 hrs.  
100 ft.  $\frac{1}{2}$  in. cond. at 5 hrs./100 ft. . . . . 5.00 hrs.

Total . . . . . 8.25 hrs.

In the latter estimate the time is one hour or approximately 11 percent low. Such errors destroy the profit ordinarily figured. Had there been no outlets at all, the estimate for the conduit would have been 5 hrs. as against the correct estimate of 4 hrs, and the error would have been 20%.

For accurate estimating one must charge labor to the item occasioning it.

## TIME STUDIES—OUTLET BOXES

## Time in Minutes

Operation	Ceiling Outlet	Bracket Outlet
<b>1. Time Studies (roughing)</b>		
Distribute Material . . . . .	1	1
Locate Outlet—layout . . . . .	5	6.5
Knockout (2) . . . . .	1	1
Thread Pipe (2 1-2 in.) . . . . .	8	8
Place Box . . . . .	2.5	4
Nipple Down . . . . .		6
Install Cover . . . . .		3
	17.5	29.5
<b>2. Time Study (finishing)</b>		
Poling Up . . . . .	4.5	4.5
	22	34
<b>3. Pro Rata Time</b>		
Study Time . . . . .	1	1
Preparation . . . . .	2	3
Pick up scattered outlets, unavoidable delays, etc. . . . .	2.75	3.5
	27.75	41.5
<b>4. Supervision . . . . .</b>	3.5	5.2
	31.25	46.7
<b>5. Final adjusted unit for particular job . . . . .</b>	32	47
<b>6. Units (in hours) established for labor-unit tables include revisions to fit the general run of jobs:</b>		
Ceiling Outlets (no plaster cover) . . . . .	35 min. ea.—58 hrs./100	
Bracket Outlet . . . . .	49 min. ea.—82 hrs./100	

From Electrical Estimating, Pg. 49, McGraw-Hill Book Co.

# High Wiring Safety

**How an aluminum working platform was designed and constructed to aid and protect electricians installing lighting standards and navigation lights on bridges of the New Jersey Turnpike.**

AMERICA'S latest and most modern high-speed vehicular parkway, the New Jersey Turnpike, incorporates 263 concrete and steel structures along its 118-mile right-of-way. These structures include toll booths, restaurants, maintenance depots, service stations, radio towers, administration and police buildings. They also include a series of bridges, the longest having a 7100-foot span. Electrical work in and on all of these structures, together with all highway lighting, transformers and distribution equipment, was installed by the coordinated efforts of two New Jersey contracting companies: Lightning Electric Service of Newark and Emerson Garden Electric of Elizabeth. The electrical contract approximated \$2-million.

Since the installation was a race against tight time schedules, it is noteworthy that time was taken to double check all construction features, detail all field problems and plan for the protection of both personnel and equipment.

Accent on personal safety was particularly stressed on the various bridge projects where men—many of whom had been accustomed only to intermediate heights and indoor work—frequently installed conduit, fittings, lighting standards and navigation lights high above rivers, railroad tracks or busy highways passing beneath the Turnpike.

When working in such locations it was mandatory for the men to use safety belts and lines, and to work from a specially-constructed platform suspended from railings. (Fig. 1)

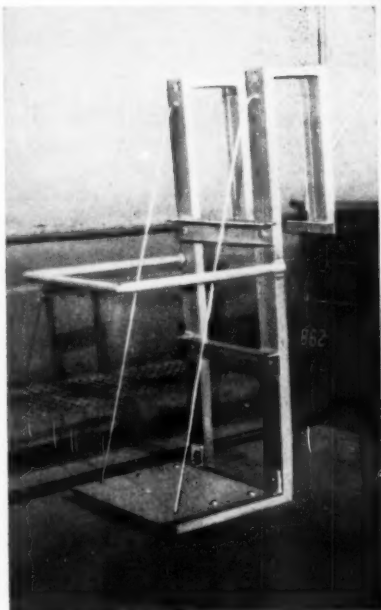
The platform, a 28-inch square of  $\frac{1}{4}$ -inch plywood, was bolted to framing sections of 5-inch aluminum channel which in turn were bolted and welded to 6-foot vertical channels of similar cross-section. In addition,  $\frac{1}{4}$ -inch steel tie rods were angled upward from the outside corners of the platform to the tops of the vertical channels for added support. Three feet above the platform a guard

rail was installed, fabricated from 1 $\frac{1}{2}$ -inch aluminum tubing and secured by welding. Steps, consisting of 3-by-4-inch aluminum angle sections, were bolted and welded on 2-foot spacings to the vertical channels, and provision for hooking the rig over bridge railings was obtained by adding inverted stirrups to the tops of the vertical channels. Continuing the practice of double safety, knees of stirrups were welded, drilled and reinforced by bolted interior angles.

While the weight of the rig was sufficient to prevent it from swaying or shifting under any anticipated actions, it was further insured against possible dislodgment by the installation of steel threaded anchor rods which were inserted through holes drilled in the vertical channels at points beneath the bridge railings. (Fig. 2) Rapidly-turned butterfly nuts speeded installation of these rods.

With the rig so positioned and so secured, workmen could go over the side of the bridges and work below the level of the roadbed with convenience, ease and safety. Belts and safety lines that passed around the railings were other precautions against workers slipping or falling from their otherwise-precarious positions. (Fig. 3)

For raising and lowering the platform, a rig was designed for one of Lightning's small trucks, constructed from lengths of 1 $\frac{1}{2}$ - and 1 $\frac{1}{4}$ -inch steel pipe. (Fig. 4) Two of these pipes were bent to form a 2-legged support for the third section which served as a boom for supporting a 2-sheave block. Sockets were secured to the truck body to hold the feet of the three sections, and all of the pipes were drilled at their common points of intersection to permit the insertion of a fulcrum pin. With one man steadying the rig as it was lowered over the side and with a second man controlling the tension on the tackle (Fig. 5), the platform was easily and quickly positioned.



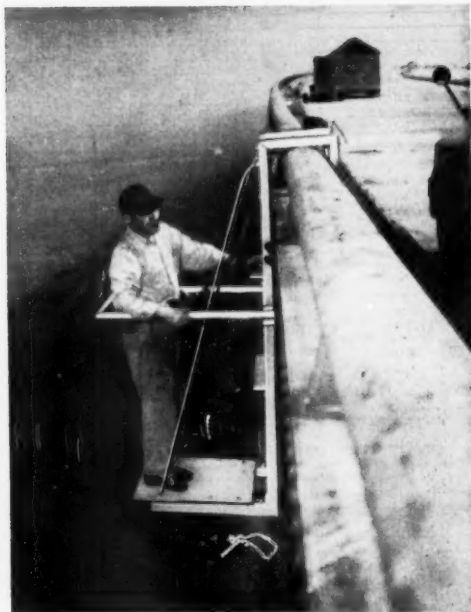
1—Aluminum working platform is welded and bolted. Assembly is supported by . . .



4—Rig for lowering and raising the platform was fabricated from pipe and could be assembled and secured



**2**— Inverted stirrups that pass over the railing of the bridge, prevented from shifting by installation of anchor rods. Added safety is obtained by . . .



**3**— Safety belt and line that is secured around the bridge railing. With these precautions, workers installed electrical fittings with ease and security.



quickly to a light truck body, used to facilitate putting platform in place. Rope was passed through a . . .



**5**— Two-sheave block at outer end of the boom. One man steadied the platform while a second man regulated the tension on the hoist line. This investment prevented material waste, speeded progress, prevented any serious injuries.

RB46		RB46	
Routing	Date 4-18-52	Routing	Date 4-18-52
Printed	Shipped	Printed	Shipped
Q.T.	Qty	Q.T.	Qty
Name	Quantity	Name	Quantity
Address		Address	
S.P. 1/2	S.P. 1/2	S.P. 1/2	S.P. 1/2
Type: P.F. 4.3	Type: P.F. 4.3	Type: P.F. 4.3	Type: P.F. 4.3
Value: 4.40	Value: 4.40	Value: 4.40	Value: 4.40
App. 12.6	App. 12.6	App. 12.6	App. 12.6
Bar No. 305744	Bar No. 305744	Bar No. 305744	Bar No. 305744
Working	Working	Working	Working
Shore 1/2	Shore 1/2	Shore 1/2	Shore 1/2
Rating 1/2	Rating 1/2	Rating 1/2	Rating 1/2
Condition P.R.	Condition P.R.	Condition P.R.	Condition P.R.
Shut-In P.R.	Shut-In P.R.	Shut-In P.R.	Shut-In P.R.
Test. Synch. P.	Test. Synch. P.	Test. Synch. P.	Test. Synch. P.
Crated	Crated	Crated	Crated
P.R.	P.R.	P.R.	P.R.
Overhaul P.R.	Overhaul P.R.	Overhaul P.R.	Overhaul P.R.
Shut-In P.R.	Shut-In P.R.	Shut-In P.R.	Shut-In P.R.
Bar No. 305744	Bar No. 305744	Bar No. 305744	Bar No. 305744
NOTIFY 9-30-52 (W)	NOTIFY 9-30-52 (W)	NOTIFY 9-30-52 (W)	NOTIFY 9-30-52 (W)
Card 1	Card 2	Card 1	Card 2

FIG. 1—Front page of both cards (side by side) shows printed form for insertion of pertinent motor data. Card 2 (right) stays with motor.

# Check List Cards BOOST Shop Efficiency

Printed job cards at Scherer Electric Co. list materials and shop operations for motor repairs; reduce mechanic's paper work yet provide accurate data and records for costing.

**P**ROFITABLE motor repair shop operation depends to a large extent upon knowing exactly what it costs to repair equipment coming into the shop. Otherwise, management has no means of knowing whether it is heading for profit or loss—particularly in the present high material and labor cost market. Regardless of cost accounting method used, a complete record of all ma-

terial and labor operations applied to each repair job is a basic requirement.

A unique check list card system does this job very nicely at the Scherer Electric Company in Indianapolis, Indiana. Used successfully for quite some time, this method precludes the possibility of inadvertent omission of material or labor items which should be charged to a spe-

cific repair job. It provides management with accurate costing records at a minimum expenditure of mechanic's time on shop paper work. And there is no excuse for slip-ups.

Two folded, printed "cards" are used. Each measures 4½ inches wide and 9½ inches high when folded; 8½ inches wide when open. For purposes of identification let's call them Card 1 and Card 2. Card 1 is of fairly



FOLDED JOB CARDS of light yellow color are filed alphabetically in standard time-card rack at shop superintendent C. C. McLean's desk; facilitate replies to inquiries.



SAMPLE COILS of repaired motors tagged for job identification and essential data are normally kept for a year, then join the scrap pile.







Retiring president M. F. Zack and Mrs. Zack, Mason City, Iowa; new president R. A. Scherer and Mrs. Scherer, Indianapolis, Indiana.



C. R. Durand, H. N. Crowder, Jr. Co., Allentown, Pa.; Mrs. H. A. Lilly and H. A. Lilly, Tampa Armature Works, Tampa, Florida.



Sleden F. High, Sullivan Electric Co., Cincinnati; Mr. and Mrs. F. B. Wiperman, St. Louis; E. M. Fagan, Fagan Electric Co., Little Rock, Ark.; C. B. Kaska, Chicago Electric Co., Chicago.



J. C. Hardie, Industrial Electric Equipment Co., Dallas; W. J. Engel, T. B. McCabe Co., Philadelphia; G. R. Lieber, Shreveport Armature Works and Carl Pons, Carl Pons Electrical Co., Shreveport, La.



N. G. Welch, Electric Service, Inc.; H. E. Grant, Tennessee Electric Motor Service—both of Nashville; M. G. Miller, Tennessee Electric Motor Service, Knoxville, Tenn.



C. R. Medsker, Miller-Seldon Electric Co., Detroit; F. H. Cannon, Cannon Electric Co., Brookhaven, Miss.; Roy Biersch, Martindale Electric Co., Cleveland; A. D. Coppinger, Coppinger Machinery Service, Bluefield, W. Va.

## At NISA's Chicago Conference

Camera highlights of NISA's 19th Annual Convention recently held at Chicago's Conrad Hilton Hotel.

**N**OTHING contributes more to the success of a convention than the people who attend. Feature speakers, panel experts, conference chairmen and committee members, attentive delegates and guests, product exhibitors and their personnel—all are necessary participants of a well organized conference.

The recent Chicago convention will long be remembered as the largest (to date) in NISA's history. More than 900 shop operators and guests from some 34 states and Canada enjoyed the outstanding program. From the lens of our roving camera, we present a necessarily small cross-section of that most important ingredient of any convention in action—the persons who were there.



Emil J. Shumberg, Shumberg Electric Co.; Leo Glynn, Glynn Electric—both from Houston, Texas.



Ben F. Whaley, Whaley Electrical Service, Columbia, S. C., participates in a technical forum.



E. N. Rude, Marshfield Electric Motor Co., Marshfield, Wis. Orville Ellefson, Forks Electric, Grand Forks, N. D.



E. T. Watkins, E. T. Watkins Electric Motor Service, Rochester, Minn.; Ray Adams, Powerite Electric Motor Co., Austin, Minn.



George R. Lockwood, Lockwood Electric Motor Service, Trenton, N. J.; Patrick J. Gallagher, P. J. Gallagher, Kingston, N. Y.; Joseph T. Gallagher, Commodore Elec. Co., Albany, N. Y.



Trans-continental panel of experts at transformer forum: (L to R) Samuel Heller, New York City; J. F. Ferrari, Chicago; C. J. Covington, Mt. Vernon, Ill.; R. E. Ward, Raleigh, N. C.; J. R. Horton, Phoenix, Ariz.; G. A. Phares, Oklahoma City; George Larsen, Los Angeles.



James Burch, Cleveland Electric Co., Birmingham, Ala.; John F. Loyd, Loyd Electric Co., Inc., San Antonio; Walter Ziegenbein, General Bearing Co., Chicago; and Albert Brazzel, Bedford Electric Co., Bedford, Ind.



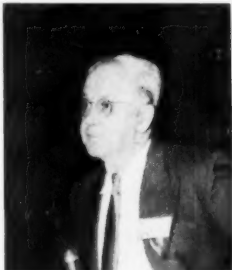
H. L. Patchett, Industrial Electric Co., Everett, Wash.; R. G. Jones, Southern Industrial Marketers, Beckley, W. Va.; Meyer Friedkin, Electric Enterprise Co., New York City.



L. J. Greenfield, New York City; W. C. Reeves, Monticello, Ind.; R. B. Floyd, Champaign, Ill.; A. O. Kleen, Austin, Texas; R. E. S. Swan, Hanover, Pa.; Walter Bailey, Washington, D. C.; and Samuel Heller (seated), New York City.



Fred W. Kiemle, The Fred W. Kiemle Co., Toledo, Ohio; H. B. Nussbaum, V. M. Nussbaum & Co., Ft. Wayne, Indiana.



Charles French, French-Gerleman Electric Co., St. Louis, brings up a pertinent engineering question at a forum session.



C. W. Nunn, Swanson-Nunn Electric Co., Evansville, Ind.; and C. J. Covington, Dowder Electric Machinery Works, Mt. Vernon, Ill.



Paul Martin, president, Northwestern Electric Co., Chicago; Clayton Doremire, Dow Corning Corp., Midland, Michigan.



Joseph F. Ferrari, Excel Electric Service Co., Chicago, who master-minded the program agenda and forum sessions.



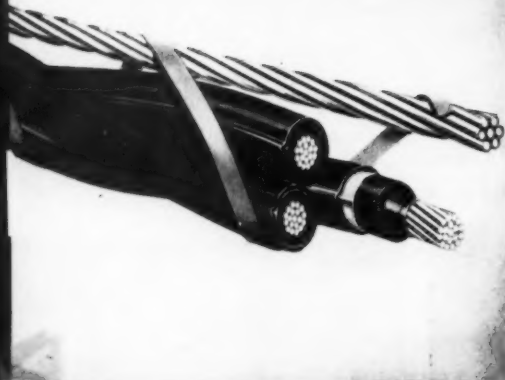
Michael E. Assalone, Florida Electric Motor Co., Miami, Fla.; J. F. Downer, J. F. Downer Electric Repair Shop, Lilesville, N. C.



A. A. Ludke, Ludke Electric Co., Inc., Vicksburg, Miss.; Paul T. Bonham, Tri-State Armature & Electric Works, Memphis, Tenn.



Durward V. Harris, Motorite Electric Co., Dayton, Ohio; and S. J. Stewart, S. J. Stewart Electric Co., New Orleans.



**SELF SUPPORTING CABLE** has in-built messenger and spiral-wound metal binding tape which passes around conductors. Cut-away view shows construction.

# PREASSEMBLED AERIAL CABLE

This trim, light-weight means for carrying current has numerous advantages and applications for the industrial plant. Here are the basic facts concerning its selection, installation and splicing.

By Hugh P. Scott

**E**CONOMICALLY, the initial cost of a preassembled aerial cable installation is considerably less than underground construction. Compared with open-wire construction it is basically higher, but where open wiring requires the use of higher poles, extra hardware, trimming of adjacent trees or additional labor, the total yearly cost of self-supporting cables frequently proves to be less. Therefore, where the expense of underground wiring is not warranted, yet where open-wire construction would not give complete satisfaction, preassembled aerial cables render a definite service.

Aside from cost, its use is recommended in localities where high winds, ice or sleet loads are possibilities. Here the high dielectric and tensile strengths of self-supporting cables minimize the possibility of mechanical or electrical failure, prevent short circuits and lessen the likelihood of abrasion. Also, since cables can continue in use when on the ground, even pole breakage will not necessarily interrupt service.

Maintenance (again referring to open wiring for comparison) is another item where savings can be effected, since savings can be obtained when selecting capacities for lightning protective equipment.

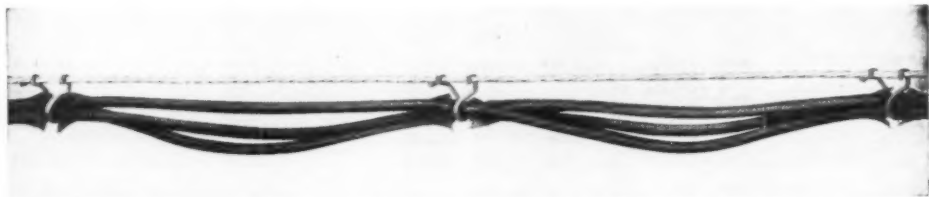
Preassembled aerial cable is also recommended for its appearance, because even three-phase circuits call for only a single, compact, cable requiring no additional cross-arms or brackets. Furthermore, binding the conductors closely together, better voltage regulation is obtained.

Preassembled aerial cables are flexible, light, compact factory-made products combining either one or several insulated and protected conductors with supporting messengers, the messenger and conductors being bound together by means of a spiral-wound metal strip. Available in many combinations, these assemblies provide a selection of conductor sizes, insulation characteristics and messenger types.

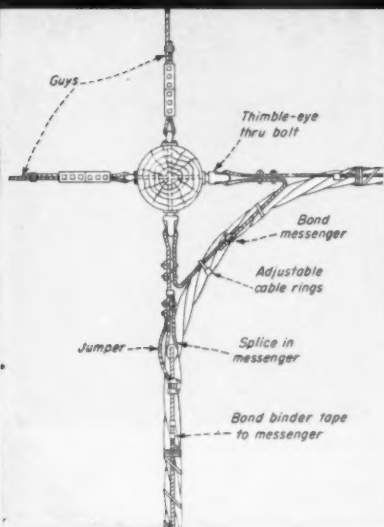
Popular combinations include single conductors used in single-phase un-

grounded circuits where voltages are below 5-kv and where the hard-drawn copper messenger (having approximately the same conductivity as the conductor) can serve as a ground return. Other cables with wide applications are 3-conductor assemblies, likewise designed for voltages below 5-kv. Then there are popular single- and 3-conductor assemblies designed for 7.5 and 15-kv grounded neutral services. All of these combinations utilize high grade rubber insulation. Although cables specified for the lower voltage ranges are sheathed only in a neoprene jacket, the higher voltage assemblies are shielded either by bronze or stainless steel tape wrapped over the insulation.

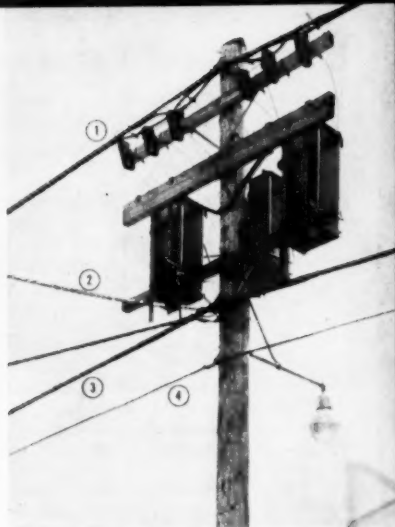
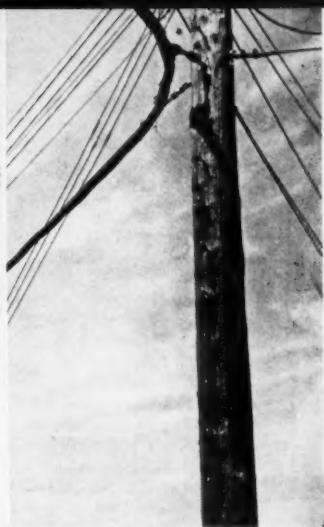
While aerial cables have been used for many years to distribute power, there recently has been a noticeable increase in their use due to the accumulated experience on the parts of manufacturers and users. With accurate engineering data now available, it is possible to rapidly select cables



**CONVENTIONAL SUSPENSION** of braided-covered cables frequently results in a frayed and deteriorated cable sheath, the resultant contact of conductors with each other or with grounded rings, low surface resistance and heavy current drainage.



**CABLE TURN AT CORNER POLE** is made without cutting either messenger or cable by the installation of guy wires, thimble-eye bolts, jumpers and supports as indicated.



**APPLICATIONS** include primary cables (1), customer service circuits (2), secondary lines (3) and lighting circuit (4).

for specific applications, consulting a comparatively small list for types and sizes.

In industrial plants it can be used both indoors and out: indoors when power circuits can be carried high in the trusses where it is safe against damage, and outdoors on either poles or brackets attached to plant buildings. As a compact means for carrying current, it minimizes congested wiring and can be used in close quarters.

#### Installation

Aside from erection and guying of poles, preassembled aerial cable can be installed by a line crew of from seven to ten men; a team consisting of foreman, truck driver, four linemen and four groundmen being recommended.

Tools for installation include those normally used for heavy line construction work, plus two special types of cable running blocks. Of these, one is designed for use on tangent poles, the other for use on angle poles. Tangent pole blocks have either wooden or alu-

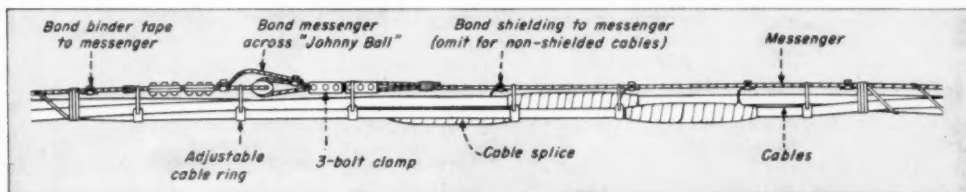
minum sheaves with wide, deep grooves to accommodate the largest cables anticipated. Frames are either bolted to poles, using one bolt to secure both frame and messenger clamp, or fastened by means of a chain clamp encircling the pole. Angle pole blocks are similar except for the frame mounting which permits the block to swing laterally away from the pole when the cable is pulled in, in that way preventing the cable from riding up on the side of the block.

Installation of the cable begins with drilling holes in the mounting poles at the proper elevation for cable messenger clamps, mounting the cable running block and threading the pulling-in rope in the sheave. Each lineman is assisted by a groundman who keeps the required tools and material moving upwards by means of a tool bag and hand line. Several poles are rigged before cable pulling actually begins.

Power for pulling is supplied by fastening the pulling-in rope to either a winch or to the drawbar of the line

truck. The other end of the rope is attached with a swivel connection to the end of the cable messenger. As the cable is unreeled, a groundman keeps the cable from becoming fouled or kinked. He also regulates tension on the cable by operating a braking device, regulating the speed of unreeling to the speed of the pulling truck. As the cable approaches each pole, it is guided through the running block by a lineman who makes sure that the sheave is turning freely, that the cable is not dragging over any of the hardware, and that there are no twists in the back spans. When the lineman is assured that the cable is passing through the running block smoothly, he descends, proceeds to a pole further along the line of travel, and repeats the operation until the cable is completely unreeled or until either the end of the line or a dead end is reached.

The entire procedure is under the guidance of the foreman who stations himself in a position from where he can check the progress of unreeling,



**DETAIL OF SPLICES** shows method of installing messenger connectors, clamps, adjustable cable rings and flexible bonds (for shielded cables). All splices (messenger and cable) are staggered. Binding tape is secured by multiple wrapping.



## PREASSEMBLED AERIAL CABLE (continued)

watch the activities of his linemen, and signal his truck driver when required.

### Dead Ends

For the purpose of dead ending, preassembled aerial cable is manufactured with several additional feet of messenger at the ends of each length of cable. Dead ending, of course, occurs at the beginning and end of each cable project. In addition, large angles and junctions frequently require dead ending and guying in each direction of run. Temporary dead ends should be established when the distance between permanent dead ends is greater than the footage of a single reel of cable.

It is customary to install cable lengths progressively from starting to end point, splicing messengers as the work progresses. However, the final reel of cable is set up at the terminating dead ending position, the cable is pulled backwards along the line to the last temporary dead end and the continuity of messenger is completed with a final splice.

### Splicing

Messenger splices make use of conventional messenger connectors and clamps. By initially overlapping the ends of adjacent messengers by about 4 feet, splicing crews are given sufficient cable to stagger the joints of a multi-conductor cable and to permit messengers to pass through the connector and be doubled back along their own lengths for clamping. With single-conductor cables, an overlap of about a foot permits splices.

The final messenger splice requires the aid of the line truck winch and a winchline passing through a snatch block on the dead end pole to a messenger grip. As the grip on the temporary messenger connection is slackened, this auxiliary anchor can be removed. Final tension and sag adjustment is secured by means of chain falls or guy pullers.

Copper binding tapes are unwrapped at splice points to permit messenger to pass through connectors and be bent back along their own length. After messenger splices are completed, binding tapes are rewrapped around overlapped sections to provide temporary support pending their final splicing.

Splices and terminations of preassembled aerial cables should be moisture-proof and have dielectric strengths equal to the cable installation. Splices are made with copper cable connectors, cement, and insulation, are staggered for appearance and compactness, and

are finally covered with friction tape, copper shielding braid and a plastic covering tape. Flexible bonds are established between the several ends of the cable shielding and messenger.

### Selection and Advantages

Single phase 5-kw grounded neutral cables generally run from number 6AWG to 4/0 in size, have current carrying capacities between 89- and 337-amps, and resistances (for conductor and messenger) between 0.5 and 0.05 ohms per 1000 feet. Three-phase 5-kv, 7.5 kv and 15-kv cables have slightly smaller ranges of ampere and resistance ratings. Since cable weights vary from 442 pounds per 1000 feet (single conductor, 5-kv, shielded, grounded neutral) to 4200 lbs/1000 ft (3-conductor 15-kv ditto), messenger characteristics are likewise variable, going from 3 x 7 (with a permissible tension of 2770 pounds) to 5/8" (designed for a 5900 pound tension). Tension is determined by the formula:

$$T = WS^2/8d$$

where T is the horizontal tension in the messenger (pounds), S is the length of the ruling span (feet), W is the weight of the cable and messenger together (lbs per ft) and d is the sag (feet). Ruling span is the average span plus 1/3rd the difference between average and maximum spans.

Specific requirements of cables, of course, depend upon the voltage range and the number of conductors required. For voltages of 5-kv and below, neoprene jackets are recommended, although bronze or stainless steel shielding tape is also available. Shielding is used for voltages above 5-kv.

Conductor size depends upon current-carrying requirements and permissible voltage drops. Tables can be secured from all manufacturers.

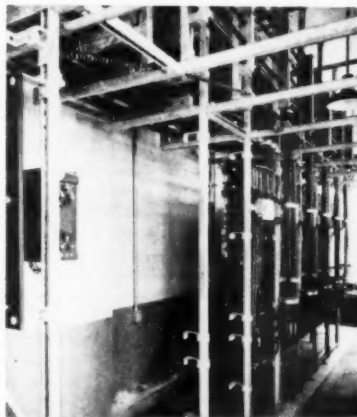
In review, it should be noted that self-supporting preassembled aerial cables have the following advantages:

- (1) Reasonable cost, (2) good appearance, (3) no messenger rings required, (4) simple to install, (5) light weight, (6) long permissible spans, (7) less congestion on poles, (8) over-length poles not needed to clear adjacent trees, (9) tree trimming minimized, (10) fewer service interruptions, (11) messenger serves as neutral, (12) lower reactance improves circuit regulation, (13) clearance span past buildings is minimized, (14) grade clamps not required, (15) resistance against storm damage, (16) lead sheaths not required, (17) stock items minimized, (18) improved conductivity, (19) higher voltage insulation, (20) permanent covering.

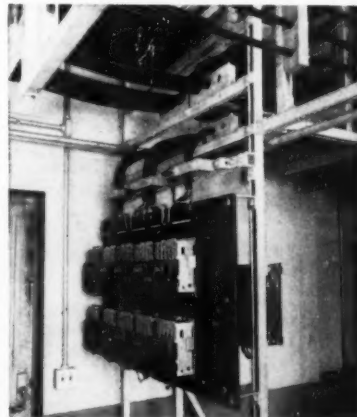
End



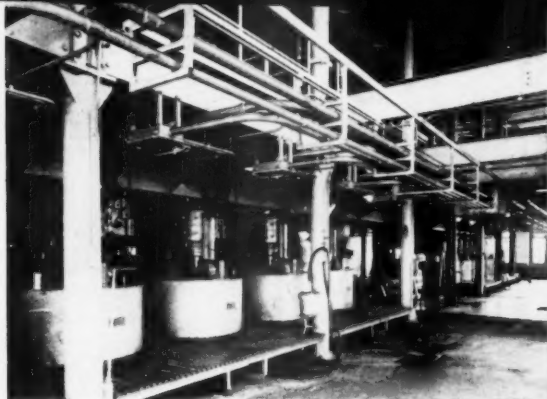
**SIX-TIER TRAPEZE** bar of strut sections carries concentration of heavy conduit feeders.



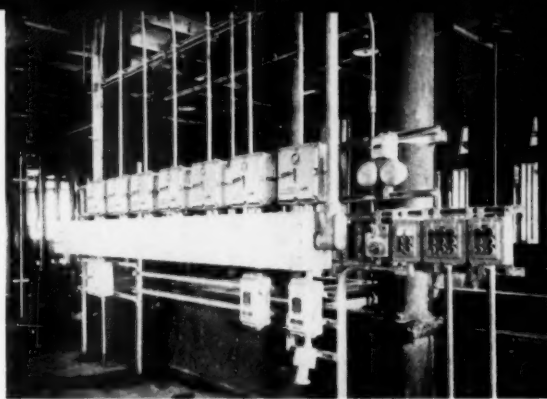
**COMBINATION CABLE AND CONTROL** rack in centrifuge control room. Maple block cable clamps support open feeder.



**CLOSEUP OF A PROCESS TIMER PANEL** in centrifuge control room showing details of cable supports.



**FEEDERS AND CONTROLS** for centrifuge motors are supported by trapeze hangers. Lateral channels of back-to-back strut are clamped to cross beams.



**BANK OF MOTOR CONTROLS** on strut rack typifies standard method of grouping miscellaneous control equipment throughout plant. Note feeder conduit and trough.

# Flexible Framing Speeds Plant Rewiring

Engineering detail and construction time were kept to a minimum through use of Unistrut metal framing in rewiring American Sugar Refining Company's Chalmette plant.

By **Z. K. Remy**, *Electrical Engineer, C. W. Nussbaum Electric Company, New Orleans, Louisiana*

**C**OMplete rewiring of the huge Chalmette Refinery of The American Sugar Refining Company, makers of Domino Sugars, resulted in an extensive electrical construction program. With basic engineering done by Baker and Spencer, Inc., of New York, the actual installation was under the supervision of the following American Sugar technical personnel: plant engineer Arther Luehrmann, construction engineer D. J. Coles, and electrical engineer Harry Hall. A large part of the work was done by the C. W. Nussbaum Electric Company and the rest by the Refinery electrical department.

During nearly all phases of the construction program it was necessary to support heavy loads—conduits, cable raceways, switchgear, timer-control panels, motor control equipment and other electrical apparatus. In the past, support problems such as these were solved by using structural steel members and channel-iron and angle-iron racks. But this normally requires considerable time-consuming detail layout work with nec-

essary cutting, punching, drilling and welding of various members; plus the special equipment needed.

## Modern Products Speed Construction

Time was an important factor in this specific project. All concerned were seeking a means of doing the job quickly and easily with a minimum of dislocation throughout the plant area. To accomplish this, the engineers chose a flexible metal framing system called Unistrut—with its strong, square cross-sectional type framing member equipped with a continuous slot with in-turned edges to hold spring-supported nuts and bolts at any point along its length. serrations on the face of the nut contacting the edges of the channel slot provide clamping action and prevent slippage even when heavy equipment is mounted in a vertical plane.

The variety of fittings available with this system permitted quick construction of practically any type of rack and support needed with only a hacksaw and wrench. Also simplified was the problem of supporting

conduits, equipment, open-wiring control cables, and other raceways either separately or in combination grouping. How this was done is clearly illustrated.

Biggest advantages noted by both plant and contractor's engineers included:

1. Great reduction in engineering detail layout because of the extreme flexibility and adjustability of the framing system. Layout dimensioning was practically eliminated.

2. Construction time was kept to a minimum because of fast on-the-job assembly and general erection ease. Last-minute shifting of racked equipment could be easily made to match conduit or cable entries—instead of training heavy cables or bending conduits to meet equipment requirements as when mounted to drilled racks.

3. Future changes and additions to the existing framing structures can be easily made. Also, all framing members can be re-used should a major change be in order.

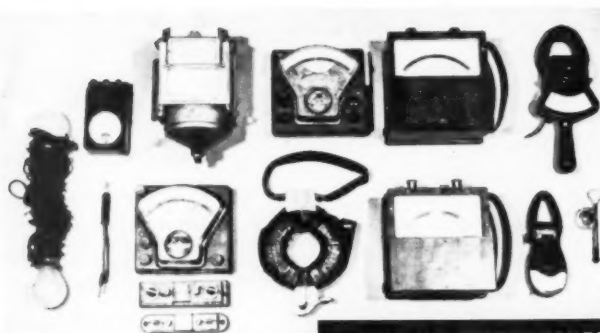
4. No welding, drilling, punching and special tools were required.



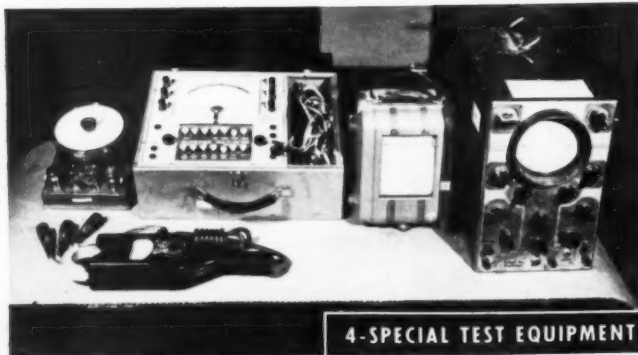
**1-TOOLS FOR THE MAINTENANCE KIT**



**2-SECONDARY TOOLS**



**3-TESTING INSTRUMENTS**



**4-SPECIAL TEST EQUIPMENT**

**By Walter J. Prise**

*Chief Engineer,  
The Maintenance Company, Inc.,  
New York, N. Y.*

**T**OOLS and instruments for electrical maintenance work can be divided roughly into two categories—primary equipment and secondary equipment. Primary equipment consists of those hand tools, power tools and instruments which make up the working kit of the maintenance mechanic and are used generally for maintenance work. Secondary equipment includes the tools and instruments which are used only occasionally in special phases of the work. Usually, a small room or locker is set aside for storing the secondary equipment which can be quickly dispatched to the mechanics when necessary.

Because proper tools and instruments are so essential to effective electrical maintenance, care should be taken to see that they are adequate within the scope of the maintenance operation. The following sections list the types and uses of tools and instruments required for preventive maintenance and general repair and trouble-shooting. A discussion of larger tools and special shop equipment is beyond the scope of this article.

## TOOLS

**MECHANICS TOOL KIT** should contain a wide assortment of small tools and accessories. The following is recommended (Fig. 1, left to right)

*Gas pliers*—A handy tool for general work on wire, small pipe, bolts and other small objects.

*Adjustable 10-in. wrench*—For work on larger motors and machines.

*Adjustable 8-in. wrench*—For work on smaller motors.

*Screwdrivers*—One or two heavy



# MAINTENANCE TOOLS AND INSTRUMENTS

Effective electrical maintenance requires a wide assortment of tools and instruments for trouble-shooting and repair. The following discussion covers the types and uses of primary and secondary maintenance equipment.

screwdrivers for heavier work on large bolts and screws and for many uses which screwdrivers have.

*Small screwdriver*—For smaller work where it can be used to advantage.

*Allen screw wrenches*—Medium sizes for use when Allen screws are used.

*Ball point hammer*—Small or medium, for knocking drive pins and keys out of shafts, for loosening of tight parts, for disassembling of end bells, etc.

*Cutting pliers*—For bi-sectioning and skinning heavier wires.

*Long nose pliers*—For making wire loops, gripping in tight places, etc.

*Diagonal cutters*—For working with small wires.

*Tap set and holder*—For threading small holes.

*Center punch*—Used for marking parts before dismantling begins and for center punching of holes.

*Small cold chisel*—For chipping stubborn burrs and rivets and for driving-off pulleys, etc.

*Undercutting file*—For use on commutators, to undercut mica, etc.

*Flat 10-in. file*—Used for heavy filing jobs, such as keys, shafts, etc.

*Small paint brush*—For cleaning the inside of motors, removing dirt from brush holders, etc.

*Hack saw blades*—For use as a small saw, for undercutting commutators and for scraping surfaces. The complete hack saw can be carried in the kit when there is enough need for it to justify its added weight.

*Commutator stone*—For correcting flat surfaces on a commutator and for cleaning surfaces when turning of commutator is not essential.

*Brush sealer*—For adjusting the brush to the surface of the commutator.

*Sandpaper and canvas pads*—For filing

and polishing commutator.

*Rubber and friction tape*—For insulating connections and joints.

*Pencil*—For on-the-spot notes and incidental bookkeeping.

*Wire brush*—For scouring hard-to-clean surfaces.

*Fuse puller*—For pulling fuses with ease and safety.

*Sharp knife*—Very handy for miscellaneous cutting work.

*Flashlight and 6' wooden folding rule*—Both have many uses on the job.

*Hardware and spare parts*—A tool kit should include an assortment of the most commonly used bolts, screws and nuts and an assortment of brushes for emergency replacement. Soft rags or waste should also be carried in the kit.

**SECONDARY TOOLS** are used only occasionally in maintenance work. These tools can be stored in a place from which they can be quickly dispatched to any job. An adequate complement of such tools is as follows: (Fig. 2)

*Thermometer*—For checking temperature on suspicious parts.

*Feeler gages*—To measure clearances and to determine wear on bearings.

*Spring balance*—For checking tension on brush holder springs and controller coils.

*Electric drill*—For on-the-job drilling.

*Soldering iron*—For making permanent connections.

*Air blower*—For periodic cleaning of motors and other assemblies.

*Air hammer and set of chisels*—For heavy cutting.

*Rawhide mallets*—For driving shafts and other parts which would be damaged if a metal hammer were used.

*Pulley-puller*—For removing stubborn

pulleys from shafts.

*Sledge hammer*—For heavy hammering work.

*Set of drift pins*—For knocking out motor end bell holding rods.

## INSTRUMENTS

**PRIMARY INSTRUMENTS** are used for routine maintenance testing and repair. Only the smallest of these should be carried by the mechanic, and only when necessary. Primary instruments should include the following: (Fig. 3)

*Test lamp*—A commonly used home-made instrument used in testing fuses, checking circuit continuity, and, if a carbon filament lamp is used, in distinguishing between series and shunt fields.

*Neon tube tester*—A handy device for quickly locating a "hot" circuit.

*Ohmmeter*—A good replacement for the old test lamp, providing mechanics understand its use. Very useful for testing the resistance of motor fields, resistors, holding coils, etc.

*Megohmmeter*—For checking insulation resistance and testing for grounds.

*Ammeters*—For load testing on motors and main and branch circuits, for checking load balance on different phase legs, etc. On dc circuits, shunts must be used, although direct reading dc instruments are available. A set of 50 millivolt shunts can be obtained to fit condition of load and must be used with 50 mv instruments. In some cases, direct reading instruments are preferable for personnel who are inexperienced in the use of shunts.

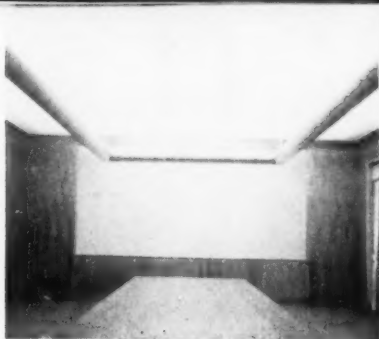
In most cases, current transformers must be used for ac work. With 5 (Continued on page 164)



Office of the Comptroller General



Office of Secretary to Assistant Comptroller General



Conference Room

**INDIRECT LIGHTING** is provided in the Conference Room and all office areas of the Comptroller General's suite by

suspended fluorescent Type K luminaires. Light source is T-8 slimline lamps operated at 300 ma. The indirect reflec-

## Special Lighting at GAO

Lighting equipment and techniques used to light public areas in General Accounting Office building were specially designed and selected to conform to architectural treatment, provide specific lighting results.

By **Berlon C. Cooper**

**T**HE lighting of all public areas and of the Comptroller General's suite in the government's new General Accounting Office building, Washington, D. C., is accomplished with luminaires of special design, and with special application of standard lighting equipment and devices. While the building has been occupied since last August (EC&M, September, 1951) when lighting was installed in all general office areas, installation of special lighting has only recently been completed, production and delivery having been delayed due to materials shortages.

This installation is of interest in that all large public buildings follow the principle of lighting special and public areas with special lighting designs and layouts, or with standard designs using special finishes and otherwise selected to conform with the architect's design and decorative treatments of such areas.

At GAO, two types of lighting treatment were selected for special lighting. Indirect lighting was selected for the conference room and all office areas in the Comptroller General's suite, for the main corridor and elevator lobbies

on the street level floor, and for the telephone switchboard room. Recessed troffers were used for most other public areas, such as in the main entrance vestibules and lobbies, in the corridors, the cafeteria, and over the escalators including upper and lower landings. Troffers in main entrances and vestibules and in the cafeterias are equipped with diffusing glass panels, while louvers are used in other locations. Use of these built-in elements provide functional lighting where needed, and maintain clean architectural treatment in keeping with the general design of the entire building.

Indirect lighting in the Comptroller General's suite is accomplished by means of suspended indirect fluorescent luminaires (Type K), equipped with two or three continuous rows of T-8 slimline lamps, operated at 200 or 300 ma., as required for each area. These luminaires are run in parallel rows in some offices, and formed in squares or rectangles in other offices. The resulting lighting intensities average 30 footcandles.

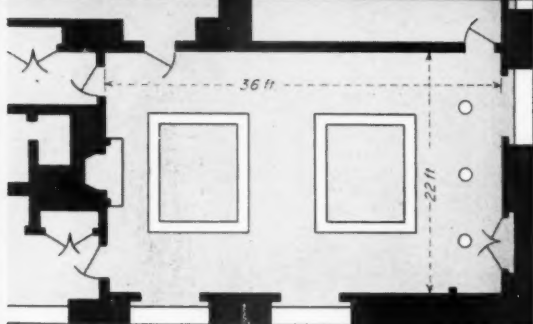
Main floor lobbies are cove lighted, using T-6 slimline fluorescent lamps in the coves (Type F) operated at 300 ma., to provide an average of 15 footcandles.

Bulletin boards and telephone booths

are effectively lighted by specular aluminum reflectors recessed in metal housings, designed to project a strong asymmetric light distribution to provide even illumination over the areas involved in each case. Bulletin boards are inclined at an angle to aid in providing even illumination. Reflectors in telephone booths are located at the front edge of the booth ceiling, so that maximum light may be directed to the telephone dial and the directory shelf. Both vertical and horizontal illumination is approximately 25 footcandles at points where needed.

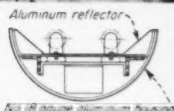
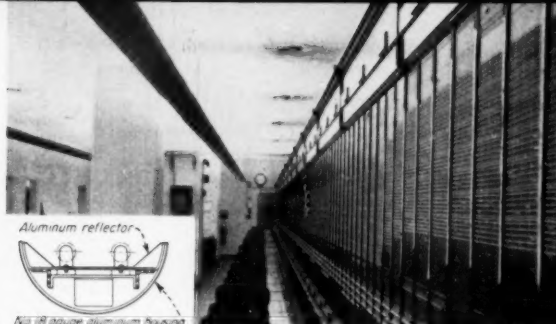
The accompanying illustrations are typical for the installation, and cover some of the more important designs. All special lighting fixtures were included in the general contract. They were manufactured by Moe-Bridges Corp., Sheboygan, Wisconsin, and were furnished and installed by Joint Adventurers (Harry Alexander, Inc., Edward C. Ernst, and the Howard P. Foley Co., Inc., all of Washington, D. C.), electrical contractors for this project. All luminaires and lighting were designed and specified by the Lighting Group, Mechanical-Electrical Section, Design Branch of Public Buildings Service, General Services Administration, U. S. Government, Washington, D. C.





Lighting Plan—Comptroller General's Office

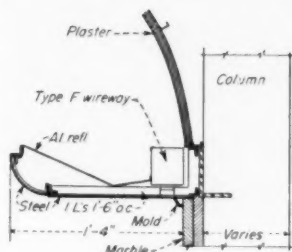
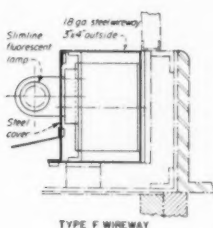
tors are arranged in square and rectangular patterns and in continuous rows for the various office areas. The standard



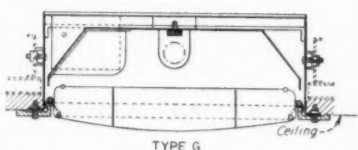
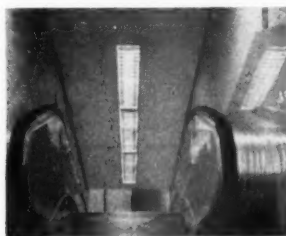
Type K

Telephone Switchboard Room

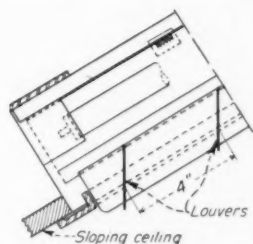
PBS Type No. 367 indirect luminaire is used to light the telephone switchboard room. Average intensity 20 footcandles.



COVE LIGHTING in main corridor and first floor lobbies provides 15 footcandles, using 42T6 slimlines operated at 300 ma.



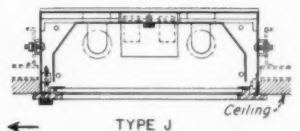
TYPE G



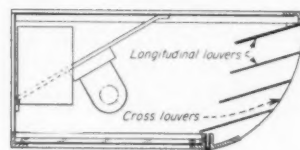
RECESSED TROFFERS light escalators and landings. Louvers in sloping ceiling are installed vertically for maximum shielding.



RECESSED TROFFERS with glass diffusing lenses light main entrances and entrance vestibules.



TYPE J

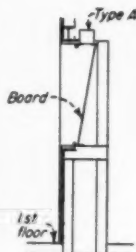
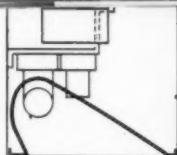
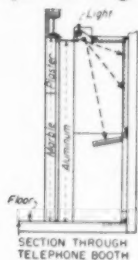


TYPE AA



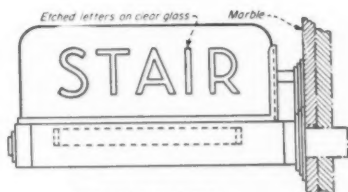
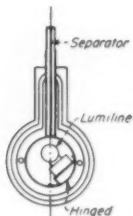
SPECIAL LUMINAIRE using continuous single slimline lamp lights low ceiling in assembly room and foyer.

## Special Lighting (continued)

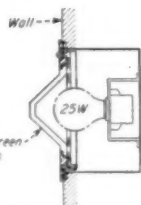
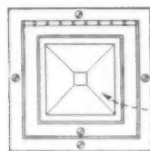


**TELEPHONE BOOTHS** are brightly lit, with 25 footcandles on dial (vertical) and on directory (horizontal) by asymmetric light distribution from recessed specular reflector.

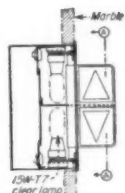
**BULLETIN BOARDS** are evenly lit by using asymmetric reflectors and tilting boards.



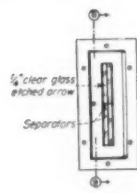
TYPE W LOBBY SIGNS



TYPE T EXIT SIGN

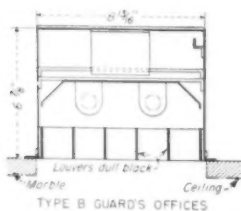


TYPE X ELEVATOR SIGN

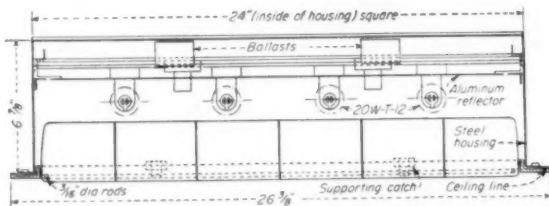


Section A-A

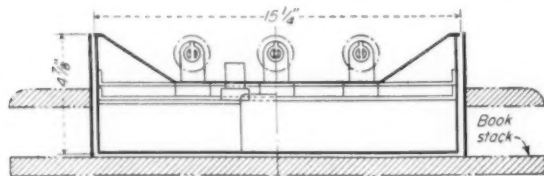
**DIRECTIONAL SIGNS** are custom designed to harmonize with architectural details, made of aluminum with satin finish.



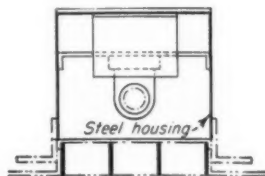
TYPE B GUARDS OFFICES



TYPE C ESCALATOR LANDING

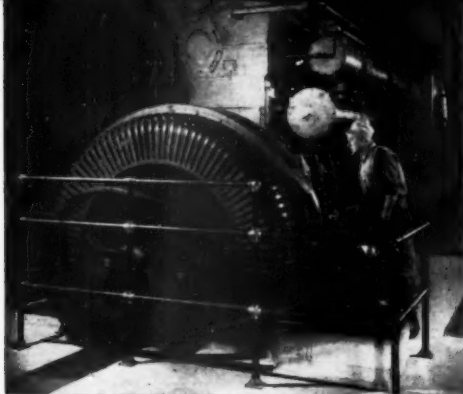


TYPE D LIBRARY

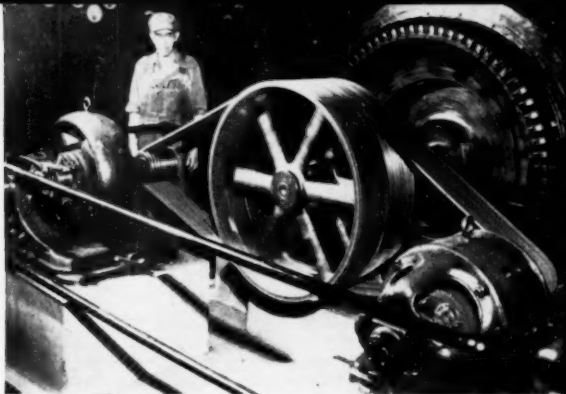


TYPE E ELEVATOR DOORS

**RECESSED UNITS** were used for general lighting in most public areas. These are typical, designed to meet special requirements.



**"SPEED UP" DRIVE** from large generator permits use of small, high speed exciter which occupies little space and provides a highly efficient, economical and compact installation.



**DOUBLE V-BELT DRIVE** from one generator transmits power to two exciters simultaneously—one to the generator itself, the other to a large synchronous motor.

# V-Belt Fundamentals

Properly engineered V-belt drives provide economical power transmission with definite savings in space and equipment.

By Frank H. Rumble

Texrope Drive Dept.  
Allis-Chalmers Mfg. Co.

**W**HILE engineering of V-belt drives is fundamentally within the realm of mechanical engineering principles, the selection of the proper drive and reasons for so doing are of interest to all electrical men specifying, installing or operating motors, exciters, generators and similar rotating equipment. In fact, the efficient performance and life of such equipment depends to a large extent upon the application of the proper drive.

Of further interest is the extent to which the selection of an adequate V-belt drive for any application is based upon the characteristics of the motor used. The motive force, of course, can be any type of prime mover, but as a matter of record it is estimated that more than 98% of multiple V-belt drives in use transmit power from individual electric motors.

Since V-belt engineering principles are well established, an adequate drive usually can be obtained by following

instructions outlined in catalogs of any reputable manufacturer of either V-belts or sheaves. Methods in these catalogs may vary, but all are based on the same fundamental principles of belt ratings, speed, horsepower and characteristics of driver and driven machine.

## Cheap Drives Are Not Always Economical

Rather than explain in detail how to engineer a V-belt drive, this article will attempt to point out why various factors must be considered in order to select a drive which is both economical and soundly engineered.

It is readily apparent that the most economical V-belt drive for any application is one that renders the most efficient service over the longest period of time. From an engineering standpoint, the best drive combines low first cost with low maintenance.

Nominal horsepower and rpm of a motor provides a logical starting point in determining the ultimate design but, in addition, the designer must consider:

- 1) The characteristics of the motor and driven machine,
- 2) Overload capacity,

- 3) Sizes of belts and sheaves,
- 4) Belt velocity,
- 5) Arc of contact, and
- 6) Conditions under which the drive operates.

V-belt drive selection must be based on the motor and load factor as well as on horsepower and speed, rather than on the basis of motor nameplate alone.

The first thing to be noted is the manner in which the characteristics of the motor can affect the selection of the drive (See Table I). For example; it makes a difference whether the driving unit is a squirrel cage motor with high starting torque, a dc motor with comparatively low starting torque load, or perhaps a slip ring motor with inherent capacity to withstand considerable overloading. Some types require more overload capacity in the drive than others.

Similarly, the load thrown on the drive in starting and running depends on the type and characteristics of the driven machine. The shock load of a crusher, for example, requires more reserve horsepower-transmitting capacity in the drive than a smoother operating machine tool or centrifugal

TABLE I

PRIME MOVER	Starting Torque	Pull-Out Torque	Constant or Variable Speed
<b>Squirrel Cage Motors</b>			
Normal Torque (Line Start) .....	110 to 150%	200 to 250%	Constant
Normal Torque (Compensator Start) .....	110 to 150%	220 to 250%	Constant
High Torque .....	200 to 300%	200 to 400%	Constant
<b>Wound Rotor Motor (Slip Ring Type) .....</b>	150 to 250%	200 to 250%	Variable
<b>Synchronous Motors</b>			
* Normal Torque .....	110 to 125%	150 to 250%	Constant
High Torque .....	160 to 200%	250 to 400%	Constant
<b>Single Phase Motors</b>			
Repulsion and Split-Phase .....	230 to 500%	250 to 400%	Constant
Capacitor .....	150 to 200%	175 to 200%	Constant
<b>Direct Current Motors</b>			
Shunt Wound .....	50 to 100%	{ 150% Peak }	Both
Compound Wound .....	50 to 100%	{ Momentary Load }	Both

pump. A conveyor may pose still another problem. Considerable more power is often needed to start a load than to drive it at normal speed.

Typical service factors for various types of prime movers range from 1.0 to 2.0; average about 1.4. To arrive at the "actual" horsepower capacity to be used, multiply the rated horsepower of the motor (ie, the nameplate rating) by the service factor. This will insure the proper margin of safety. When in doubt, it is better to run the risk of overbelting a drive rather than to underbelt it.

#### Bare Minimums Are Risky

Proper engineering of drives requires adequate belt and sheave sizes for both economy and efficiency. Reducing the sizes of either for first cost saving usually increases the overall cost beyond justifiable limits.

Selection of sizes (cross section) of V-belts depends upon the horsepower of the drive and the speed of the motor or driven machine, whichever is the greater (See Table II). Based on nominal horsepower, this table is the result of experience in engineering thousands of drives. While there may be some exceptions, its recommendations are usually found to be correct and, in most cases, to offer the only logical choice in selection of the proper belt section.

Sheaves smaller than "permissible" minimums can be used with various size belts only at a great sacrifice of belt life. The reason for this is that sheave diameters have a definite relationship to the width and thickness of the belts used on any V-belt drive. Standard rubber V-belts are constructed, of fabric, cord and rubber

compound in proportions which experience has shown to stand up longest under the work the belts are designed to do. The bending of a V-belt in a natural, easy arc determines the smallest sheave that can be used without distorting the belt. If it is bent beyond this "easy arc" by use of a sheave whose diameter is too small, its super-structure is disarranged and internal friction causes it to heat and deteriorate.

Although laboratory tests and service records show that reasonable belt life can be expected with sheaves as small as the permissible minimum, it is better to use sheaves somewhat larger than the minimum if at all possible. Use of the larger diameter sheaves means less flexing of the belts, reduction of internal heat and friction, and consequently, longer belt life. For example: use of a 5.4-inch or a 4.6-inch sheave with "B" section belts is not the difference between success or failure of the drive. It will operate. But use of a 6.0-inch instead of a 4.6-inch sheave will make considerable difference in the life of the belts. If belts on a 4.6-inch sheave have a life of two years, under likewise favorable circumstances, it would not be unusual with a 6.0-inch sheave for the drive to have a belt life of from four to six years, or more.

Larger diameter sheaves may cost more, but belts do not need to be replaced as frequently. The cost of replacing only one set of belts usually offsets the difference in cost of slightly larger sheaves.

#### Belt Velocity Affects HP Capacity

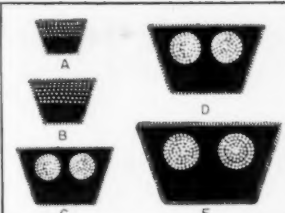
The maximum diameter of sheaves used on a drive is governed by space

limits and belt velocity. The first condition requires little explanation. If space does not permit as large a diameter sheave as desired, the only other choice is to try to use a smaller one with grooves for enough belts to drive the load safely. Such drive may not be the most economical, but it will be the best engineered for existing conditions. Belt velocity requires more detailed explanation. Between practical limits, the larger the diameter of the driving sheave, the greater the velocity of the belt and the more horsepower each belt of the drive is capable of transmitting. For greater efficiency belts should not travel too fast or too slow. When considering practical limits governing belt velocity, horsepower rating tables for standard belts usually show a recommended belt velocity between 1000 and 5000 feet per minute.

There is a reason for these limits. A belt at slow speed transmits less horsepower than when it is traveling faster. So a multiple V-belt drive as a whole requires more belts when speed is low. Since the power rating of a belt is quite low at a velocity of less than 1000 feet per minute, it is not economical nor good engineering practice to go below this point on most drives.

An equally good reason exists for limiting maximum belt velocity. As belt speed approaches and exceeds 5000 feet per minute, the tension is increased and centrifugal force tends to stretch the belts and throw them away from the grooves. This lessens the effective arc of contact on the sheaves and an appreciable part of the traction effect is lost. Safety is another consideration. Most cast iron sheaves are constructed to withstand safely a rim

GENERAL TEXROPE BELT SUGGESTION TABLE						
Motor Hp	Motor or Driven Machine Speed Whichever is the Greater					
	3600 to 2400	2000 to 1450	1200	900	720 to 600	514 to 450
$\frac{1}{2}$ — $1\frac{1}{2}$	Use cross section					
2 — 5	A					
$7\frac{1}{2}$	B					
10 — 20	B					
25 — 40	C					
50 — 75	C					
100 — 150	D					
200 and over	E					



Minimum Sheave Sizes	
Permissible	Recommended
3.0 inch	A ..... 4.0 inch
5.4 inch	B ..... 6.0 inch
9.0 inch	C ..... 10.0 inch
13.0 inch	D ..... 14.0 inch
21.6 inch	E ..... 23.0 inch

speed not in excess of 5000 feet per minute. While special drives are sometimes constructed for use at lower or lighter speeds, it is best to stay within the recommended limits on the average drive.

From this it can be seen that belt velocity and sheave diameters are opposite sides of the same coin. One depends to a large extent upon the other. Sheave diameters should be large enough to insure good belt life, yet not so large as to produce excessive belt velocity. Larger diameter sheaves sometimes permit the use of fewer belts on a drive. This not only reflects a saving on both the original cost and replacements, but actually lowers initial cost of the complete drive. Part of the saving is effected in the lower cost of the sheaves. Because of machining costs it is almost always true that sheaves of slightly larger diameter but with few grooves are lower in cost than sheaves of slightly smaller diameter but with more grooves.

To illustrate how larger diameter sheaves affect the horsepower-transmitting capacity of a drive, consider "D" section belts on a 13.0-inch sheave driven by a 1150-rpm motor. Each belt will have a rating of 15.3 horsepower. Used on a 14.0-inch sheave each belt would have a rating of 17.9, or 2.6 horsepower more for each belt. On the first drive eight belts have a total rating of 122 horsepower, while on the second drive only seven belts have a total of 125 hp. The second drive not only has a greater total hp-transmitting capacity and is a better engineered drive, but is actually lower in price.

Similarly, on certain drives, a fewer

number of larger section belts on larger diameter sheaves often have equal or greater hp-transmitting capacity than a greater number of smaller belts on smaller diameter sheaves. Where this is true, the drive with the larger belt section is often preferable from an engineering standpoint and, in many cases, is also lower in first cost.

#### Drives Offset Operating Conditions

The arc of contact of the belts on sheaves must be taken into account when determining the actual horsepower-transmitting capacity of each belt of the drive. Horsepower ratings for the different section V-belts are based on a 180-degree arc of contact. If one sheave is smaller than the other, the belt will have less than 180 degrees contact on it and, consequently, will have less hp-transmitting capacity. How much less can be calculated easily from the formula for finding effective arc of contact appearing in any V-belt catalog. For example: the hp rating of a B section belt at a velocity of 4000 ft/min on a 5.4-inch sheave at 180 degrees arc of contact is 4.0. The formula shows that the same sheave with 150-degree arc of contact has only .92 effectiveness or  $.92 \times 4.0 = 3.68$  hp per belt. With the exception of 1:1 ratio drives, one sheave of every V-belt drive is smaller than its companion sheave and will have less than 180-degree arc of contact. This fact should always be considered in calculating the total horsepower-transmitting capacity of the drive.

It is well to know the conditions under which a drive will operate and, if these are abnormal in any way, parts can be selected which are especially

designed to solve the problem. Designers have long been aware of the varying conditions of operation and have designed and engineered the several parts of the drive to best meet the various needs. This is particularly true of the V-belts themselves. If the drive must operate where explosive hazards exist, belts are available with the cover impregnated with a static-conducting material. Such covers tend to conduct any static charge to the motor or the driven-unit frame where it can bleed to ground. The frictional contact of any belt on a pulley or sheave may generate static electricity which, if allowed to build up, might cause a spark. Use of static-conducting V-belts reduces this hazard by bleeding off the static.

If space limitations or other factors require the use of higher than ordinary horsepower capacity per belt, regular high capacity belts are available. These have a hp-transmitting capacity of 40% more than standard belts, but usually have a higher cost as well. Steel cable belts with a minimum amount of stretch are often advantageous on a fixed center drive. If the drive must operate in an oil atmosphere or is subject to contact with oil or grease, special oil-resisting or oil-proof belts should be used. Though higher in first cost, the selection of parts which have been especially designed to meet unusual operating conditions may conceivably double or triple the useful life of the drive.

If in doubt on any point it is well to consult engineers especially trained in all phases of V-belt application. The convenient tables appearing in standard catalogs and handbooks are usually for average conditions.



# Basic Rules for INDUSTRIAL

1. Design the system within the limitations of the supply.
2. Locate the supply as near as possible to the plant electrical load center.
3. Know the requirements of the load.
4. Let the requirements of the processes, production and the relative importance of the six major characteristics determine the type of distribution system.
5. Select and arrange feeders and equipment so that interruptions never occur more than the process will allow.
6. Select all components from the source to the load for reasonable future growth.
7. Don't be limited by N E Code figures for conductors, conduit and protection which are minimum and primarily for safety.
8. Use load centers when feasible.
9. Select the cable construction with the best all-around characteristics to meet your conditions.
10. Let your ultimate goal always be production efficiency, quality and safety.

**A**N industrial plant is only as good as its electrical distribution system. The electrical distribution system is only as good as the contractor makes it. Ordinarily, the contractor can convince the owners that a good job is the best; but if the initial investment looks high, remind them of these three things:

1. Over a period of years, the better quality of service, greater flexibility, reliability and decreased operating and maintenance costs will more than pay for the higher-than-expected initial cost.

2. In a short time, freedom from troubles, and from further expense for remodeling, etc., will prove your contention for quality.

3. Most important, production will get ahead with the least delays, even with major changes in plant arrangement.

This and succeeding articles discuss some of the important features of industrial distribution systems applying to both small and large plants.

A well-planned distribution system is not necessarily more expensive than a haphazard layout of conduits, cables and equipment. In most instances a well designed system costs less than a poor one. One point should be emphasized in particular: layout of physical arrangement of circuits is one of the most difficult problems for the contractor. In planning an adequate system certain features or requirements will be of more consequence in one plant than in another. Careful analysis is required. Equipment manufacturers

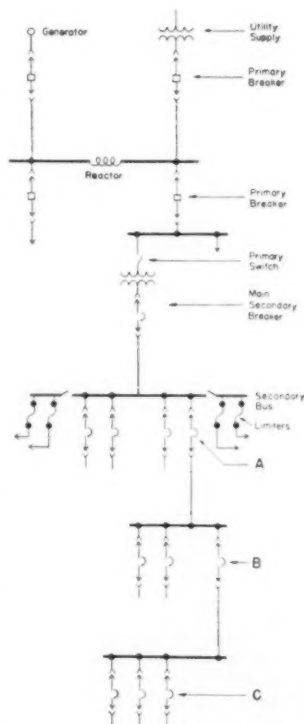
render a considerable amount of competent engineering service but their services are limited usually to the products they sell. In that respect they are well-qualified but a distribution system must contain equipment from many manufacturers and to coordinate the properties to best advantage requires skill, planning and sound engineering. If this experience is not available it is advisable to obtain outside services.

## Distribution

Distribution systems for small or large plants may be chosen from about a dozen arrangements and combination arrangements, all good, all having a field of application and all essentially one or more of 4 elements: primaries, secondaries, and radial- and network-type circuits. Fig. 2 shows 9 of these in simplified form, much switching and protection omitted. Two others not shown are the simple network, and the primary selective spot network. As readily seen from Fig. 2, the radial system is primarily a one-source feed; the network system primarily a choice of two or more feeds, accomplished with primaries or secondaries in either system.

Secondary distribution has been at one or more of these voltages 575, 440, 220 or 110, nominal rating. In later years these have been superseded except to a large extent in small plants by 480 or 600 volts. One reason is that transformer and switchgear equipment at these voltages now is standard and most economical per kva. Another is that more utilization can be obtained

**Fig. 1. TYPICAL FEEDER LAYOUT**



# WIRING DESIGN—1

By Frank Aime  
Electrical Engineer  
Anaconda Wire and Cable Co.

with 600 volt insulation on wire and cable, the first and lowest step in insulation rating.

## Nine Systems Compared

From a large number of studies of system designs and cost comparisons, the ratings in Table I have been assigned to six major characteristics. These should be of help in deciding on what system to use for a normal plant.

It is evident from Table I, none of the basic systems is outstanding. This is logical because there is no perfect system and no normal plant. Load characteristics and plant requirements vary from a so-called normal.

Assistance in selecting the best system for your job may be obtained by using weighted values for each of six characteristics. By changing weighting factors to suit the individual plant, the combined merits of the systems can be rated.

Below are representative values for analysis which may be changed to suit the job; for example, if service dependability is of prime importance, select a value higher than 2 and substitute. The overall ratings should narrow the selection to two or three systems. Knowing the load requirements, it should then be possible to select the best to meet your needs.

System Characteristic	Representative Weighting Factors
Flexibility	3
Regulation	1
Service Dependability	2
Operation and Maintenance Cost	1
Efficiency	1
Initial Cost	6

Safety should not require a weighting factor; it should be built in for any system.

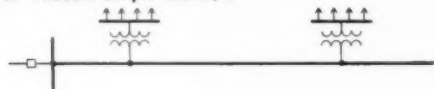
Many plants employed the simple radial system (still good under some

Fig. 2. NINE BASIC DISTRIBUTION SYSTEMS

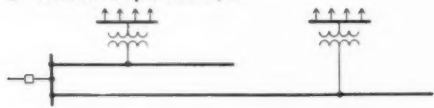
### 1 Low Voltage Simple Radial, A



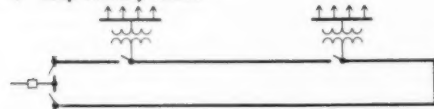
### 2 Modern Simple Radial, B



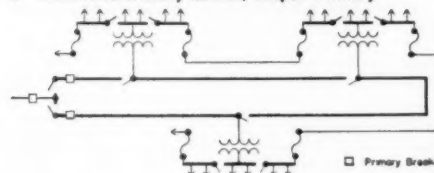
### 3 Modern Simple Radial, C



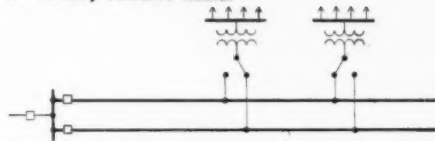
### 4 Loop Primary Radial



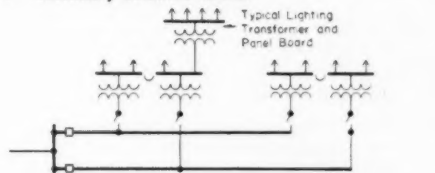
### 5 Banked Secondary Radial, Looped Primary



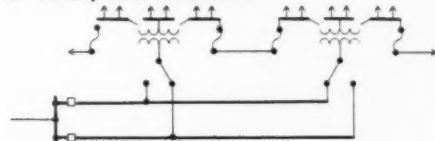
### 6 Primary Selective Radial



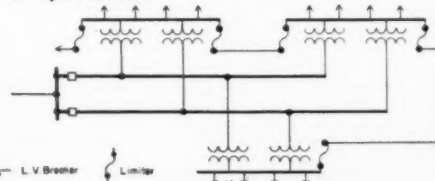
### 7 Secondary Selective Radial



### 8 Primary Selective Network



### 9 Spot Network



□ Primary Breaker

— L.V. Breaker

⬇ Load

System Type Fig. 2	Flexibility	Service	Dependency	Regulation	Efficiency	Operation & Maintenance Cost	Initial Cost
					Grading		
1	3	5	6	5	1	4	
2	6	6	4	3	1	1	
3	4	5	4	3	1	3	
4	4	5	4	2	1	1	
5	1	3	2	1	2	4	
6	4	4	4	2	1	2	
7	4	2	2	4	4	4	
8	1	1	2	1	3	4	
9	3	1	1	4	4	5	

conditions) at *secondary* or utilization voltage, 115 to 600 volts, with comparatively long feeders direct from the main switchboard. With increased load and larger plants, it was necessary to seek more suitable arrangements with less bulky cables, better regulation, better flexibility, reliability etc. Out of this grew the present accelerated trend to load or power centers, whose chief characteristic is that they are situated close to the load, with comparatively long feeders at *primary* voltage and short branch feeders at *secondary* voltage. Such are shown in unit arrangements 2 to 9 inclusive, Fig. 2.

1. Specialized engineering knowledge and experience plus a knowledge of production requirements are necessary for planning the physical arrangement of circuits.
2. Arrange circuits so it is easy to trace them and find troubles.
3. The neatest-looking design usually is the best.
4. Avoid physical, electrical and thermal "bottlenecks" in all cases.
5. Install feeders and branch circuits so the delivered voltage to a device always is equal to or slightly greater than its voltage rating.
6. Allow a portion of the total permissible voltage drop in each section of the circuit from supply to load; viz, feeder, transformer, secondary; select conductor sizes to fit.
7. Observe the Six Cardinal Points in selecting cable.
8. Standardize on a few cable sizes.

Characteristics	Transformer Type			
	Dry	Nitrogen-Cooled Dry	Askarel-Filled	Oil-Filled
Impulse-level rating	low	low	high	high
Suitable for lightning locations	no	no	yes	yes
indoor	primarily	yes	yes	yes
outdoor	—	yes	yes	yes
balconies	yes† §	† §	yes§	§
dusty	no	yes	yes	yes
semi-hazardous	no	yes	yes	no
primary substations	—	—	yes	yes
Inflammable	minor	no	no	yes
Tank sealed	no	yes	yes	yes
Insulation class	B	B, H	A	A
Code Restrictions	minor	few	minor	some
Affected by moisture	yes	no	no	no
dirt	yes	no	no	no
most corrosive conditions	some	no	no	no
Weight	lightest	heavy	heavy	heavy
Needs vault indoors	no	no	no	yes
Available with radiators, forced-air or water cooling	no	no	yes	yes
Natural air cooling	yes	yes	yes	yes
Needs ventilating provisions			some*	
Maintenance needed for	dust	nitrogen	askarel	oil

available in metal-enclosed package form, prefabricated, sectionalized and with little to do after arrival besides connecting them to incoming and outgoing lines. They can be located on the production floor without special enclosure. In addition to the above,

1. Air-cooled or noninflammable-liquid-cooled transformers for power and lighting, reducing fire hazard.

**SAFETY**—a necessary consideration. When good equipment is properly installed, safety is inherent, both for equipment and personnel.

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**TABLE III, HINTS ON SWITCHGEAR APPLICATION\***

Primary breakers (Similar to main substation breakers)	<p>Advantageous for automatic relaying and for remote control</p> <p>Use less expensive types if reliability is secured by secondary tie feeders or loops</p> <p>Oil- or askarel-filled breakers on liquid-cooled transformers</p> <p>Air breakers on air-cooled transformers</p> <p>Interrupting requirements similar to those of main substation breakers may be reduced by impedance of long feeders</p> <p>Primary switches should preferably be interlocked with secondary breakers so they do not interrupt load currents and cannot close on loaded secondary circuits</p> <p>When primary fused switches are used, the fuse should be selected to have a low enough rating to protect the transformer but with enough time delay not to open on secondary feeder faults before secondary breakers open.</p>
Secondary breakers (Such as main breakers, main feeder breakers, tie breakers, network protector)	<p>See N E Code requirements, Tables 20, 26, 27, for over-current protection for motors</p> <p>Generally in 2 classes: 1, large air circuit breakers or 2, molded-case breakers with the two having overlapping ratings; 1—Preferred in load center units</p> <p>2—Usually with thermal trips, sometimes in the smallest substations, more usually in branch circuits</p>
Oil circuit breakers	Still best for higher voltages and high interrupting capacities; mostly used at 13.8 kv and higher; being replaced below 13.8 kv for normal conditions
Air circuit breakers	Being used more and more in industrial plants; safer, less maintenance; trend is to higher voltages; standard air breakers now available to 13.8 kv operating voltage (138 kv in Europe) and 250 mva interrupting capacity; for low-voltage (600v and lower) classes, up to 75 mva.
Oil cutouts	Trend away from these in some load centers; delay in restoring service
Air-filled junction box with current-limiting fuses or oil cutouts	Preferable to oil cutouts; for high-voltage side of load center, for circuit protection and disconnecting
Current-limiting fuses	Made to standard NEC fuse dimensions; have interrupting capacity ratings 150 to 500 mva; inherently fast (less than 2 cycles), just the performance needed for branch circuits where current over 10 X normal indicates fault to be isolated before feeder breakers open; not adjustable
NEC fuses	Do not carry interrupting capacity ratings; up to 200-amp size on a motor circuit, will handle short-circuit amperes of 50,000; for branch circuit and individual equipment protection; not adjustable

\*Note: Abstracted from contributions to current literature by several switchgear manufacturers.

3. Adequate built-in, coordinated circuit protection reduces troubles, helps restore service quickly.

4. Easy to move to another location when production requirements dictate it.

Obtain more details from the equipment manufacturers.

#### Growth

Rule 6 is much more easily met by allowing a normal recommendation of 25% for immediate additions and depending on the flexibility of the layout for longer-range additions; such as installing a single-ended substation or load center for present loads and, when justified, adding another transformer and additional secondary feeders with switchgear, to make it double-ended. Several of the nine circuit layouts, Fig. 2, permit of developing necessary flexibility and other requirements necessary to the process.

#### Ducts and Conduits

In industrial plants, conduit construction is often the largest footage used inside buildings. When feeders must be carried between buildings, underground installations can be considered to be best for both primary and secondaries for these reasons:

1. Accident hazards are reduced to a minimum.
2. Ambient temperature is lowest and cable capacities are highest.
3. Cables are not in the way if it is necessary to make changes above ground.

The cost of underground construction is not always justified under these conditions:

1. Unsuitable soil conditions.
2. Destructive chemical ingredients in the soil.
3. Imminent major changes in plant layout.

For underground ducts, fibre conduit encased in concrete is most popular. Under light traffic and the weight of the duct line comparatively moderate, little concrete is needed and the top of the conduits need not be more than 12 to 18 inches below the surface, somewhat lower in cold climates.

In stretches where traffic is heavy, it is necessary to lay the conduit deeper, possibly to reinforce the concrete with steel.

All conduit runs should be laid so they will drain throughout the run (cables are always safer in dry ducts); never use loops and avoid vertical U-turns as much as possible.

Straight runs are always preferable: where bends are necessary make them



# NOTICE

## NEW FEDERAL SPECIFICATIONS

### for PANELBOARDS; EQUIPPED WITH AUTOMATIC CIRCUIT BREAKERS

Amendment 2, Specification W-P-131a

#### SPECIFICATION

Heinemann Models within Specifications

**CLASS A:** For use on a.c. systems—5,000 amperes interrupting rating, single unit, common trip breaker.

**A-1**

Single pole  
15-100 amperes,  
120 volts



No. 0411  
(15-60 amperes)



No. 0911  
(15-60 amperes)



No. 1163A  
(15-100 amperes)

**A-2**

Double pole  
15-100 amperes,  
120/240 volts



No. 2263A  
(15-50 amperes)

**CLASS C:** For use on a.c. and d.c. systems—5,000 amperes interrupting rating, single unit, common trip breaker.

**C-1**

Single pole  
15-100 amperes,  
125 volts d.c.;  
120 volts a.c.



No. 1163J  
(15-20 amperes)

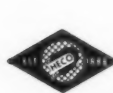
### *plus* ALL THE ADVANTAGES OF THE FULLY MAGNETIC OPERATING PRINCIPLE

Heinemann Circuit Breakers operate on an electro-magnetic principle, employ no thermal elements. Thus, they are unaffected by heat, do not require de-rating or the extra engineering work de-rating necessitates. Heinemann Circuit Breakers may be located anywhere regardless of ambient temperature, and can be reset instantly, without waiting when fault is corrected.

NEW LITERATURE: Send for your copy of "What You Should Know About Circuit Breakers."

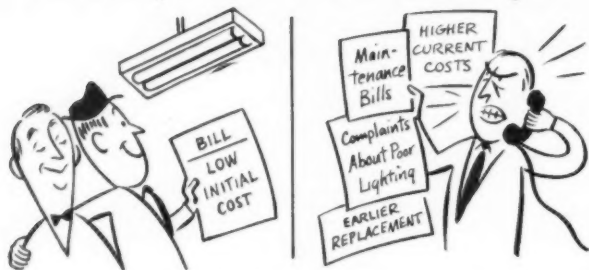
HEINEMANN ELECTRIC COMPANY, 132 Plum Street, Trenton 2, N. J.

**don't use heat...USE POWER**



HEINEMANN Circuit Breakers . . One, two and three pole . . 10 milliamperes to 100 amperes

# Will They Love You in December As They Loved You in May?



It's easy to make sales with lower cost fixtures . . . but it's more profitable to make customers by recommending the METALCRAFT quality line. Cut the *plus* costs of extra maintenance, wasted current, inadequate light, and earlier replacement out of industrial lighting budgets . . . sell and install the

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**METALCRAFT'S New  
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Ruggedly built of heavy gauge steel, die-formed for uniform construction. Quarter-turn "Shakeproof" wing nuts for easy installation and removal of reflector. Fluorescent or slimline. 2-or-3-Lamp conventional or turret sockets. Porcelain enamel or baked enamel finish. Shielding assembly optional.

**WRITE FOR NEW BULLETIN No. SN-1051**

*the Metal-craft line*

**METALCRAFT PRODUCTS CO., INC.** • Manufacturers of  
Fluorescent and Slimline Luminaires • Mascher & Lippincott Sts., Phila. 33, Pa.

## Basic Rules for Industrial Wiring Design

. . . Starts on page 86

with a long radius especially when large cable is involved. Standard bends of steel conduit are hardly ever of sufficient radius for heavy cable because they were designed for small wires.

### Power Loads

Large motors, heating and furnace loads usually are treated separately. Because of their size and importance, detailed data usually are available. Smaller and mixed loads require more careful study. Demand factors used in computing demand of these large loads are not subject to generalization; if dominant, may require 100%. The larger the group, the lower the combined demand; conversely, the smaller the group (one motor is the extreme), the higher the demand factor. A single motor or a small group may require a system based on 100% demand factor; when combined with other loads and measured at the main substation, usually will require an entirely different and lower demand factor. This means: demand factors vary with the number of units in the load group; demand factor for the entire plant is lower than the weighted-average demand factors of all the load groups.

A way of estimating loads for miscellaneous motors found in most plants is on the basis of average size motor per machine or voltamperes per square foot. These methods are most accurate in production-line plants where many machines of the same type and size are set up in rows. Where sizes vary widely, or use is intermittent, the lower values in Table below are suggested; for intensive production, repetitive processes or automatic machines, the higher values.

TABLE OF  
TYPICAL LOAD DENSITIES

Type Load	Load Density
	voltamperes per square foot
Lighting and Power . . . . .	7 to 30
Lighting . . . . .	2 to 8
Power . . . . .	5 to 25

(Continued on page 94)

# BIDDLE

## Instrument News

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

JAMES G. BIDDLE CO., 1316 ARCH ST., PHILADELPHIA 7, PA.

## IF YOU MEASURE SPEED YOUR BEST BET IS BIDDLE

### If you want—Readings of Average RPM or FPM...

—choose one of the several ranges available in **Jagabi® Chronometric Speed Indicators** from 0-100 up to 0-100,000 rpm. The shaft or spindle is set in ball bearings. No lubrication needed. Design and construction of these instruments is such that a minimum of maintenance is required even in constant, severe service.

The **Jagabi Tachoscope**, stop watch and revolution counter, is also recommended for high accuracy work.

BULLETIN 35-ECM.



### If you want—Readings of Instantaneous Speeds or Variations in Speeds

...select the **Jagabi® Centrifugal Tachometer**—speed ranges 25 to 48,000 rpm. Three—and five—ranges in one instrument... or the **Dr. Horn Tachometers** which are made with 6 ranges between 25 and 30,000 rpm. Both

Jagabi and Dr. Horn Tachometers have a special friction coupling which minimizes the damaging effects of too fast acceleration and over-speeding. Results: Low maintenance and long, dependable service life, for direct indicating, rpm/shaft/rpm linear and peripheral speeds and speed variations.

BULLETIN 35-ECM.



B418



### If you want—Quick and Accurate RPM Readings with Safety

...Consider the advantages of **Frahm® Resonant Reed Tachometers** for hand use or permanent mounting.

No contact with moving parts is required.

Just touch the instrument to the chassis, frame or housing of the machine or motor and read the rpm directly. No moving parts. No lubrication or maintenance required. Accurate to  $\frac{1}{2}$  of 1%, they will operate continuously for years without any appreciable change. Instruments with limited ranges available for as little as \$27. Practically any desired range within 900 and 100,000 rpm may be supplied.

BULLETIN 41-ECM.

## TESTING FLOOD SOAKED ELECTRIC MOTORS AND INSULATION

Megger® Insulation Resistance Testers  
Help Meet the Emergency

The spring floods of the Missouri Valley left a wake of water soaked electrical equipment that required long, tedious hours of cleaning and drying out. Megger Insulation Resistance Testers in the area were worked overtime so that the condition of all electrical equipment—motors, transformers, generators, starters and controls could be determined and put back in service as soon as adjudged dry and safe. Electrical maintenance and repair men, backed up by the electrical supply houses, did a yeoman job again this year, as they have in previous disasters. The James G. Biddle Company did all in its power to speed shipments to the area.

### "Tests When Drying Out Wet Apparatus"

Records of previous insulation resistance tests on the apparatus being dried out are of great assistance to the user of the Megger instrument. Frequent readings, made quickly and easily during the drying out process, should be plotted on graph paper with temperature readings. When insulation resistance and temperature have become constant and remain so for several hours, the equipment may be considered dry. If external heat is applied, the Megger tester should be connected for the duration of the heat run. If apparatus is to be heated by circulating current in the windings, test leads of the Megger instrument should be disconnected during application of current... and circulating current should be disconnected before connecting the Megger leads to make an insulation resistance test.

Requests for a copy of the 94-page Megger Manual should be on your company letterhead. Ask for Manual 21-J-ECM.



James G. Biddle Co.  
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☐ 35-ECM ☐ 41-ECM ☐ 21-J-ECM

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THE SOLDERLESS, TAPELESS WIRE CONNECTORS  
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**FOR ALL "PIGTAIL" SPLICES  
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Where do you use "Wire-Nuts"? If it's only for jobs like hanging fixtures, you're not cashing in even half way on the easiest method known for making perfect pigtail splices!... IDEAL "Wire-Nuts" (contractors sizes 74B and 76B) are fully approved as

pressure cable connectors for general use in every kind of branch circuit wiring—conduit, armored cable, non-metallic sheath or open.

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## Basic Rules for Industrial Wiring Design

... Starts on page 86

A listing of the magnitude and type of all connected load is an essential prerequisite to the final determination of the kva demand for the total plant as well as for each part of the distribution system. By applying certain factors to the connected load, the demand can be estimated with a fair degree of accuracy.

### Demand

Demand factor, diversity factor and load factor all affect the distribution systems. *Demand factor* is the ratio of the maximum demand of a system, or part of a system, to the total connected load of the system, or part of the system under consideration. *Diversity factor* is the ratio of the sum of the individual maximum demands of the various subdivisions of a system, or part of a system, to the maximum demand of the whole system, or part under consideration.

### Load factor

*Load factor*, which is the ratio of the average load over a designated period of time to the peak load occurring in that period, is much less important than are demand factor and diversity factor in the selection and design of a plant distribution system.

It is used more for determination of system losses and conductor size for primary and main feeders; not for branch feeders where other considerations control; such as starting requirements and N E Code limits. Daily load factor, expressed in percent, is obtained by taking the average of the sum of the square of the loads for each 24 hours and then taking the ratio of that average to the 1-hour peak load. It affects cable size because of the total amount of heat to be dissipated. For a load factor of, say, 80%, only 62.5% of the heat of a 100% load factor case must be dissipated; therefore, you may be able to buy a smaller cable at less cost and save on conduit, labor, freight, etc. all the way along. Do not, however, reduce the conductor size below that necessary for prescribed regulation.

Information as to the demand and the diversity factors for the various loads and groups of loads is needed best to design the system. For ex-

ample, the sum of the connected loads to be fed over a branch load circuit, multiplied by the demand factor of these loads, will give the maximum demand which the branch circuit must carry. The sum of the maximum demands of the branch circuits associated with a sub-load center or panelboard divided by the diversity factor of those branch circuits will give the maximum demand at the sub-load center and on the load circuits supplying it. The sum of the maximum demands of the load circuits radiating from a load center, divided by the diversity factor of those load circuits, will give the maximum demand on the transformer at the load center. The sum of the maximum demands of the load center transformers divided by the diversity factor of the transformer loads will give the maximum demand on their primary feeder. Thus it is seen that by the use of the proper demand and diversity factors as outlined above the maximum demands on the various parts of the system from the branch load circuits to the power source, inclusive, can be determined.

Information on these factors is available in the technical literature.

#### Voltage & Regulation

Motors will operate, of course, at less than rated voltage but will perform better at full voltage. Usually the efficiency of the devices decreases, the losses increase rapidly as the voltage falls below rated. With motors, power factor and torque decrease, they run warmer and in some instances at lower speed. The same principle applies to heating and welding circuits and, of course, to all lighting circuits.



**W. F. EGNER**, manager, general service division, A. O. Smith Corp.; **J. H. Runkel**, Unistrut Co.; and **Chester Seaholm**, Bull Dog Electric Co.—all in Milwaukee—check mounting facilities for equipment, at Milwaukee's E.M.E. Show.

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## **IDEAL** Voltage Tester



Proved in the service of thousands of electrical men, IDEAL Voltage Testers give you the maximum in all-important safety features for all-round electrical testing! Solenoid indicator and test lamp are in parallel—even if the coil fails the lamp will still detect voltage. The coil itself is *layer-wound*—insures highest dependability and will *not heat up excessively*. The rugged plastic case has no uncovered "windows" to allow dirt to interfere

with accurate, sensitive operation. There is no exposed metal on the case that can cause shorts with live parts. Prods have heavily insulated handles with protective rings—no chance for fingers to slip and come into contact with the prods. The entire tester is light in weight, streamlined—easy to use and carry in your pocket. Your best buy for durable quality and *low cost*!

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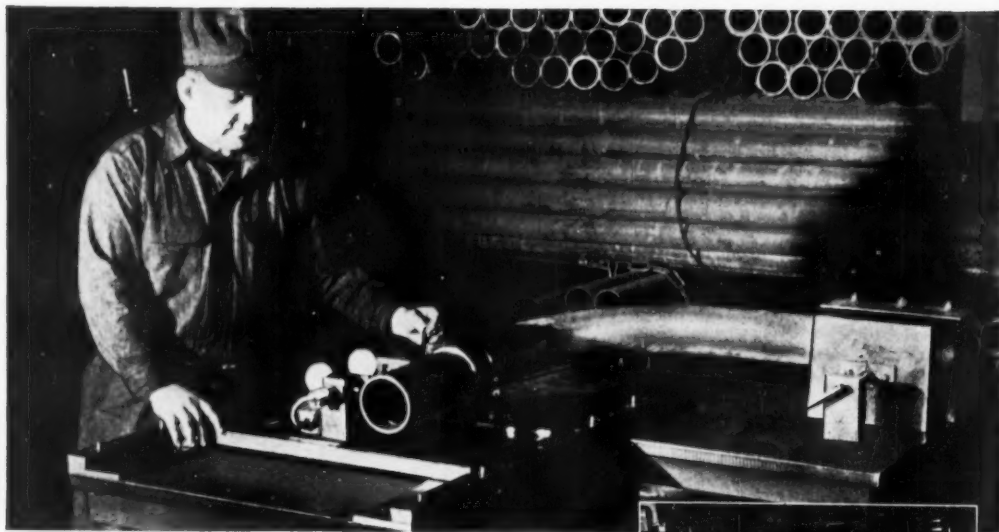
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G-E quality control inspectors put conduit elbows through this angle tester. Elbows must test within 25/100 of a degree to be acceptable for delivery to your electrical wholesaler. Engineering care like this makes your job easier in the field.

## G-E "WHITE" HAS TO MEASURE UP ON TEST AND ON THE JOB

Precision methods in the manufacturing and testing of rigid conduit help make G-E "White" the conduit that's built for easy installation, *engineered* for best performance.

For instance, an elbow that's as much as one degree off a true right angle can give you real trouble on the job—can actually throw a conduit run 21 inches out of line in every 100 feet. To help you avoid this kind of trouble, G-E quality control keeps the angle of every G-E elbow within 25/100 of a degree.

Because of this test and many others like it—exhaustive tests on zinc finish, tests for uniformity of weight, tests on the quality of steel—you can rely on G-E "White" for uniformity time after time. Begin now to standardize on G-E "White," and see what a difference it makes.

### GET THE NEW RACEWAY CALCULATOR

New circular slide rule enables you to determine at a glance proper raceway sizes and boxes for use with specified wire sizes and number of conductors. Ask your G-E Construction Materials distributor for the new raceway calculator. Section C7-618, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

*You can put your confidence in—*  
**GENERAL  ELECTRIC**



Your General Electric Construction Materials distributor can tell you about the uniformity of G-E "White" rigid conduit. He sees it every day in the week, knows it's engineered for performance.



You'll have fewer installation problems when you standardize on G-E "White" rigid conduit. Extra attention to quality at the factory means extra installation speed to the man on the job.



**WHITE  
RIGID CONDUIT**  
*engineered for performance*

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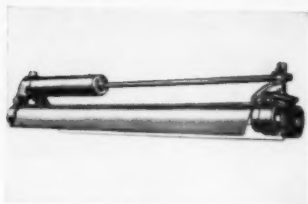
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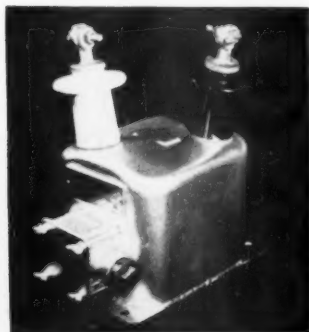
# Product News



**Fluorescent Fixture (1)**

A new series type EVF explosion-proof lighting fixtures for 36-watt, 48-inch T-12 slimline lamps. Fixtures consist of two, three or four-lamp-enclosing tubes of explosion-resisting Pyrex glass sealed into cast aluminum end fittings containing sockets. Above lamp tubes is mounted a cast aluminum ballast housing. Fixtures are supplied with sheet aluminum reflectors mounted between lamp tubes and ballast housing. Re-lamping end of unit is supplied with a toggle arrangement, permitting that end of fixture to be dropped down sufficiently to clear an adjacent fixture. Fixtures can be mounted end-to-end in a continuous strip without interfering with re-lamping. Re-lamping is accomplished by removing end fitting cover and releasing lamp by means of a bayonet joint plate on which socket is mounted. Standard fixtures are arranged for ordinary vertical mounting, but an attachment is available to permit mounting unit at an angle of 45° either side of vertical position.

*Crouse-Hinds Co., Syracuse, N. Y.*

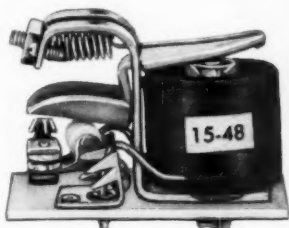


**Transformers (2)**

An improved line of indoor and outdoor potential transformers in the 2400 volt class, types PT and PTO, is available. A new crepe paper insulation that is vacuum dried and impregnated has

a high impulse and dielectric strength, and a low insulation power factor. Available in either 45 or 60 kv full-wave impulse test level, the new transformers meet the 0.3W, 0.3X, 0.3Y, and 1.2Z metering accuracy classifications. Type C Hipersil cores are used. Transformer is mounted in a single-piece, deep-drawn steel case with a welded-on base. It utilizes a no-leak filling plug, and new HV bushings mounted without bushing flanges. Single and double HV bushing combinations are available on the cover or at the end of the case. Cover-mounted bushings only can be supplied either with or without type BAL high voltage fuses. Type PTO, outdoor, is available with cover-mounted bushings only, without fuses. Both type PT and PTO can be mounted in any position.

*Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.*



**Motor Starting Relay (3)**

Several design improvements have been made in this motor starting current relay for single-phase, capacitor-start and split-phase motors. Unit automatically controls the starting winding circuit; can be used as a replacement item for obsolete centrifugal starting switches on motors from 1/6 hp, 110 volt to approximately 5 hp, 220 volt single phase. Specific improvements are: Magnetic core button is plated with a non-magnetic material and has a copper shading ring to eliminate fluttering and reduce chattering of relay armature; relay housing and armature cores are cyanide case-hardened to increase rigidity and reduce wear at armature pivotal point; low hysteresis loss magnetic characteristics of relay core are maintained for frequencies up to 60 cycles; negligible spring fatigue loss or stretch is maintained for long period at temperatures below or above normal.

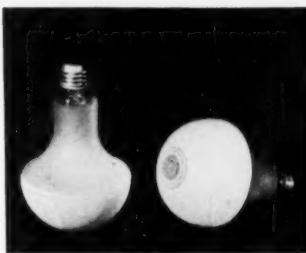
*Levins Electric Company, 1254 W. Harrison St., Chicago 7, Ill.*



**Cable Cutter (4)**

A feature of this new cable cutter is the heart-shaped design of opening between jaws, which results in clean true cuts. Designated as Catalog No. 365, it is equally well adapted to bare or insulated copper or aluminum cables up to 500,000 CM. Tool accommodates outside insulation diameters up to one-and-a-half-inches. It is especially suitable for preparing cable ends for insertion in precision type fittings. The heart-shaped opening progressively decreases the effort required, since it forces cable in toward the fulcrum as more strands are cut. Stops on handle maintain a minimum opening of three inches to prevent barking of knuckles.

*Thomas & Betts Co., Inc., 34 Butler St., Elizabeth, N. J.*



**Lamp Bulb (5)**

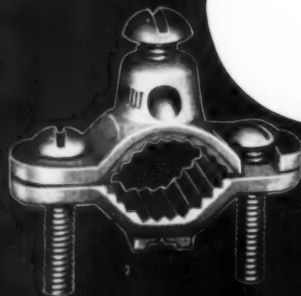
A new 100-watt lamp bulb for use in homes, apartments, hotels, restaurants, and clubs. It is a larger companion of the "50-GA" bulb with the built-in shade. The new style of bulb has a bowl which directs two-thirds of light upward to ceiling. The lower portion of the bowl is covered with a soft-toned, permanent enamel finish which filters and mellows the one-third of light directed downward. The new bulb, designated 100-GA, is approximately 3 1/2 inches in diameter at the widest point, and has a maximum overall length of 6 1/2 inches.

*General Electric Company, Nela Park, Cleveland 12, Ohio*

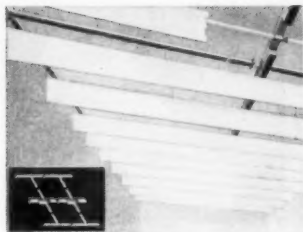


MODERN FITTINGS

**Midwest Electric Mfg. Company**  
MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS  
1639 W. WALNUT STREET  
Chicago 12, Illinois







### Lighting System

(6)

The new "Grid-Lite" lighting system utilizes a "grid" like arrangement of pre-wired channels, single-pin T12 slimline lamps and translucent shields. Because of the translucent plastic shields, which are suspended between each row of lamps, "Grid-Lite" is said to reduce system brightnesses. Such lighting is recommended for school classrooms, stores, offices, drafting rooms, and similar locations. Channels coupled one-to-another by means of a new type of built-in coupling device. Wiring consists of bringing circuit wiring into one of the knockouts provided in the sides of the outer channels. Systems can be ordered in a variety of sub-assembly, "Unit-Package" sections. Combinations of these can be laid out to fit rooms of many sizes and shapes. Systems are designed for surface-mounting installations against flat ceilings of any common material, such as plaster, wood, concrete, etc. Channel system consists of three types of channels: (1) A center or ballast channel with lampholders for one end of the lamps, (2) an outer channel with the lampholders for the other end of the lamps and (3) several spacer channels which regulate the distance between center and outer channels for lamp accommodations. All channels and covers are formed of 20-gauge steel, finished in baked, white enamel. "Intra-lok" design locks channels end-to-end without need for couplings. "Grid-Lite" systems are available with 425 ma ballasts. Also available with 200 ma ballasts, which give a lower lamp brightness and footcandle level. 48 inch, 72 inch or 96 inch T12 slimline lamps may be used.

Benjamin Electric Mfg. Co., Des Plaines, Ill.

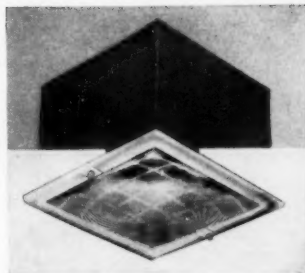
### Laminates

(7)

Low-pressure laminates with a remarkable degree of heat stability have been developed. Molded of glass cloth and Dow Corning 2104 Silicone bonding resin at pressure from 3 to 30 psi, they will withstand continuous exposure to temperatures in the range of 500°F and intermittent exposure to as

high as 900°F. Finished laminates weigh less than aluminum or magnesium and are stronger than either at 500°F. Smooth, non-porous and easily machined, they are highly water repellent and resistant to most commonly used chemicals. Laminating stocks may be preformed and used to prepare complex shapes either by bag molding or in light metal molds. Flat sections can be laminated in thicknesses ranging from 0.01 to 2.00 inches. 2104 has a low initial viscosity at laminating temperature (345°F), and a gel time which may be controlled by the addition of a catalyst.

Dow Corning Corporation, Midland, Mich.



### Incandescent Unit

(10)

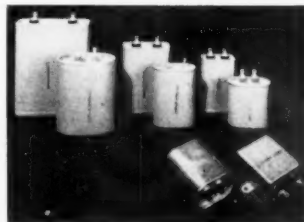
A low brightness recessed incandescent luminaire, No. F-1570. This lighting unit features a larger lens and a narrower trim. The "optical train" in No. F-1570 consists of a square prismatic reflector and a concave Controlens, which is always on the near side of the lens and thereby shielded from the observer at any normal viewing angle. Its shape facilitates better transmission of both direct and reflected light resulting in unusually high output. Cooperating with the lens and completing the optical combination is a square reflector with a dome shaped top section containing an opening for the side entrance of the lamp. Incandescent In-Built lighting systems are for use in schools, banks, private offices, stores, hospitals and public buildings.

Holophane Company, Inc., 342 Madison Ave., New York 17, N. Y.



**FLUORESCENT** lighting fixtures with an easy-open, easy-close snap-lock catch. Standard on all Litecontrol fixtures equipped with hinged lens doors, this catch permits opening with fingertip pressure on a "trigger" which protrudes through the door. Closing involves pushing the door back into place. Manufactured by Litecontrol Corporation, Watertown, Mass.

(8)

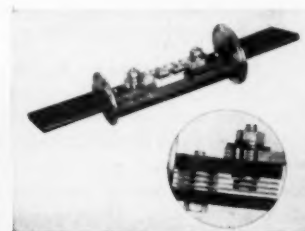


### Capacitors

(9)

A newly-designed line of capacitors with reductions in size and cost has been developed for electronic applications. They are 20% to 30% smaller in size. Basic construction of the drawn-oval capacitors is essentially the same as that of standard commercial types of fixed paper dielectric capacitors. Ratings of the new units are 2.0 muf. to 10.0 muf, 600 to 1,500 volts dc and 330 to 660 volts ac.

General Electric Company, Schenectady 5, N. Y.



### Fuses

(11)

Heat dissipating fins have been added as a new design feature on several sizes of the Monarch line of renewable knife blade type fuses. Six of these large area, brass fins are incorporated in the design—three spaced equally along each end of the fibre bar support. Because of the increased heat transfer surface, the interior of the fuses remain cooler. The fins perform the additional functions of keeping the heat away from the fibre bar. They also give support to the fibre bar. This design is incorporated in the 600 amp, 250 volt and 400 and 600 amp, 600 volt fuses.

Monarch Fuse Company, Ltd., Jamestown, N. Y.



## for timesaving...it's the GREENLEE Hydraulic Knockout Punch Driver

Perhaps you know this fine electrician's tool under its previous name—the "HYDRA-RAM".

Today, however, due to a conflict with the same name "HYDRA-RAM" for a product in another field, the name has been changed to GREENLEE Hydraulic Knockout Punch Driver.

But regardless of name—you'll still find it one of the finest timesavers available.

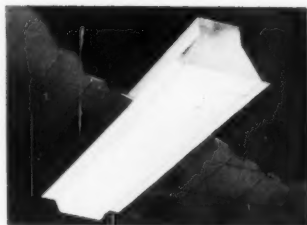
For the GREENLEE Hydraulic Knockout Punch Driver—coupled with GREENLEE Knockout Punches—makes easy, fast work of enlarging knockouts or cutting entirely new openings for conduit up to 4".

Operation is simple, fast—hydraulic pressure does all the work for you. Developing over *eleven tons* of ram force, it drives the GREENLEE Knockout Punch through 10-gauge metal with ease. Makes cutting holes in tight places easier, too, for no wrench space is needed.

Speed conduit installation jobs, save labor with this powerful, handy tool. Set comes to you packed in a sturdy metal carrying case. Get complete details—write Greenlee Tool Co., 1746 Columbia Avenue, Rockford, Ill.



**OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK**  
Hydraulic Conduit Benders • Hand Benders • Cable Pullers • Auger Bits • And Many Others



**Fluorescent Fixture (12)**

The "Surf-A-Lite", a surface mounted fluorescent fixture, has been announced. Styrene plastic louvers and a metal reflector plate can be removed for pendant mounting. Fixture features the "Spring-a-matic" louver action. Through the use of two hidden springs, which hold the louver in place, all screws, bolts and other chemical devices have been eliminated. For cleaning or relamping, a slight pressure opens the louver. Side panels are available in metal or translucent Luxtrex Styrene plastic. Unit features 45°—37° shielding and is available in four or two lamp, 40- and 20-watt models for individual or continuous mounting. Also in 4-, 6- and 8-foot slimline models. All models can be used for pendant or surface mounting.

Electro Mfg. Corp., 2000 W. Fulton St., Chicago 12, Ill.



**Tool (13)**

A multi-purpose mechanical pressure tool, designated as Model 51A Standard "Dril-Jak". It is 34½ inches long over all; motor clamp attachment fits any standard drill motor with ½-inch or larger capacity for drilling; coupling attachment has ½-inch female thread to fit motors having removable handles; extension pipes with adapters to reach 25 feet; weight 9½ pounds. It is for drilling in confined places or places where it is difficult for one operator to

maintain drill alignment. Jack pressures permit easy drilling in metal, concrete, wood, mortar, brick, tile, stone, etc. Used also for lifting, bracing, shoring, pushing, pulling, stretching, weld positioning, etc.

*Time Saver Tool Co., Inc., 2103 St. Clair Ave., Cleveland 14, Ohio*

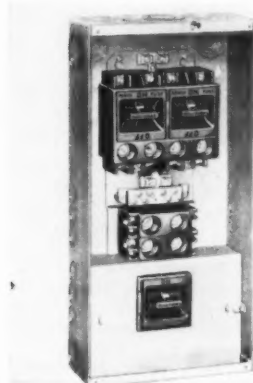


#### Connector

(14)

The 7084 double T-slot cord grip connector body has been redesigned. Some of the features are: black bakelite body has easy-find slots; extra thick steel armored section and cord grips are bright zinc plates to resist corrosion; long life contacts are accurately positioned and have spring at base, far removed from arcing point; tapered wireways and large binding screws. This device has  $\frac{1}{4}$  to  $\frac{3}{8}$  inch cord hole and is rated 15 amps, 125 volts; 10 amps, 250 volts.

*Pass & Seymour, Inc., Syracuse 9, N. Y.*



#### Service Equipment

(15)

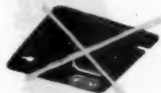
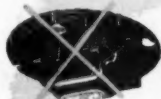
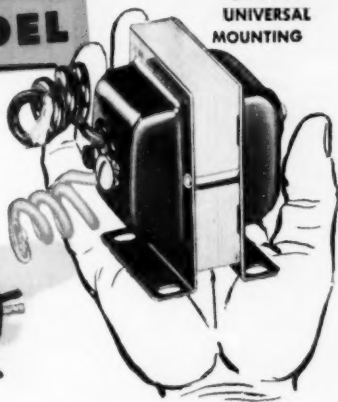
A new 100 ampere combination service equipment for special water heater rates has been announced. Many utilities have initiated plans requiring a separate feed and may require that the circuit be sealed from other portions of the entrance equipment. With the new equipment, a sealable barrier fits under the standard trim and prohibits any change or unauthorized circuits being added to the low rate loads. Devices are furnished with parallel range and main pullouts for 3-wire, 220 volt circuits and either 4, 6 or 8 plug fuse, 2-wire, 110 volt circuits. These are in

# THIS ONE LATE MODEL

10-V SECONDARY  
5-WATTS  
UNIVERSAL  
MOUNTING

#### REPLACES 3 MODELS

For Door Bells, Buzzers,  
Door Openers and  
Annunciators



#### FILL EVERY NEED STOCK ONLY ONE MODEL

The one Jefferson Universal-Mounting WIZARD Bell Transformer for operation of door bells, buzzers, annunciators and door openers replaces THREE models. Patented mounting design feature provides easy and quick attachment to any outlet box, cover, or cabinet, with primary leads for connecting to circuit and terminals for bell wires. Mounting feet are also provided for open wiring installations. No special mounting plates are required. Ideal for close-quarter installations. Stocked by Electrical Wholesalers Everywhere.

Jefferson Chime Transformers are also equipped with the Universal Mounting Feature.

JEFFERSON ELECTRIC COMPANY, Bellwood, Illinois

*In Canada: Canadian Jefferson Electric Co., Ltd.,  
384 Pope Ave., Toronto, Ont.*



## JEFFERSON WIZARD BELL TRANSFORMERS

APPROVED BY UNDERWRITERS' LABORATORIES

### RELIABLE FUSE PROTECTION

### STOPS: Unnecessary Production Shutdowns and Motor Burnouts

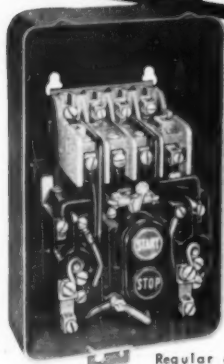
In the widely used line of Jefferson Fuses you will find the type and capacity for all lighting and power circuit requirements. For general purposes—ask for Jefferson-Union Renewable or Gem non-renewables.

For long time lag on circuits with heavy motor starting loads use Jefferson Super-Lag Renewables, or the dual-element Jefferson SAFT-LAG thermal type non-renewable fuse. Your wholesaler can supply you.

## JEFFERSON FUSES



## the NEW FURNAS 10 hp STARTER



Regular enclosure measures 10 1/4 x 6 1/4 x 4 1/4 in.; smaller than No. 2 and larger than No. 1; rated 10 hp., 220-550v AC polyphase.

The new Furnas series YE starter rated 10 hp. maximum, has a smaller, neater case with more than ample space for wiring. Other major features of interest to your starter-customers include:

- **LOW CONTACT-RESISTANT SILVER CONTACTS WITH SPECIAL ARC-QUENCHING PROPERTIES,**
- **TERMINAL BOARDS OF HIGHEST ARC-RESISTANT PLASTIC AVAILABLE,**
- **DUAL VOLTAGE COILS, STANDARD EQUIPMENT ON BOTH SINGLE AND POLYPHASE STARTERS, AND**
- **POSITIVE ACTING, SOLDER-POT TYPE THERMAL OVERLOAD UNITS.**

For a 10 hp. starter or contactor, engineered for better performance and longer life — providing economy of size and price — recommend a Furnas control. Catalogs and price sheets sent on request. Write Furnas Electric Company, 1067 McKee Street, Batavia, Illinois.

OTHER  
MOTOR  
CONTROLS

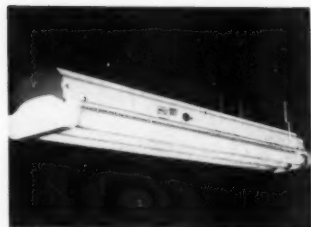
We manufacture other sizes of magnetic starters and contactors as well as drum controllers, pressure and foot operated switches. Details on request.



**FURNAS**  
*Electric*  
**MOTOR CONTROLS**

addition to the independent and sealed 3-wire, 220 volt circuits. For the conventional application, the independent circuit may be rewired into the 60 ampere bus tap and the barrier omitted. Similar units, with conventional bussing and pullouts for range, water-heater and main, are available with either 4, 6 or 8 plug fuse circuits. Other units are equipped with 100 ampere main pullout which controls range, waterheater and up to 16 plug fuse circuits.

Square D Company, 6060 Rivard St., Detroit 11, Mich.



### Commercial Fixture (16)

A new line of open type commercial fixtures featuring turret sockets. Designated the "Chieftain" series, they are available in 2 and 3 lamp 48, 60 and 96 inch conventional and 48, 72 and 96 inch slimline. Fixtures are finished to provide resistance to oxidation in installations where extreme humidity or other adverse conditions prevail. There are no welded parts. Components are approved ballasts, starters and turret sockets. Units are adaptable to all types of mounting. End piece may be removed and channel coupler added to provide an open wireway any length. Knockouts are provided for continuous row mounting where open wireway is not required.

Gibson Manufacturing Co., Atlanta, Ga.

### Service Station Lights (17)

A new line of weatherproof continuous horizontal fluorescent "T" lights for service stations has been announced. The line consists of two basic 30 inch wide fixtures—one 4-ft in length, the other 8-ft. They are designed to be installed separately or with a coupling device, using various combinations to form continuous rows in lengths of 12 ft, 16 ft, 20 ft, 24 ft, etc., to meet the requirements of any size island. Units can be fitted to existing poles, or come equipped with specially designed 9-ft or 12-ft tapered octagon standards. They are furnished complete with slimline fluorescent



lamps, wired ready for installation, and listed by Underwriters' Laboratories, Inc. for outdoor use. Extruded aluminum glass frames have airplane type cowl latches. Knockouts are provided in bottom plate to permit a variety of mounting centers, and in cover plate for installation of spot or flood lamp-holders.

Guardian Light Company, 301 Lake St., Oak Park, Ill.



### Locking Plug (18)

"Cor-Lock" is the name of a new heavy-duty locking plug. Waterproof, shock-resistant jointure is achieved by molded rubber construction. Approved by Underwriters' Laboratories for 20 amp at 250 volt, and 10 amp at 575 volts. Available in these flexible cord sizes: 18-3 and 16-3 SJ; 18-3, 16-3, 14-3 and 12-3 in S, SO and SJO hard-service coverings.

Cornish Wire Co., Inc., 50 Church St., New York 7, N. Y.

### Conduit Fittings (19)

A new series of conduit fittings for hazardous areas, Class I, Groups A and B. Designed primarily to meet the need for conduit systems in these locations, the fittings also meet the requirements for all other hazardous locations. Fittings are made of aluminum alloy and are available in sizes of 1/2 in., 3/4 in., and 1 in. in the basic shapes of straight, Tee and X. Approved by Underwriters' Laboratories.

Hazardous Area Equipment Corp., 277 West St., New York, N. Y.

# CRESCENT

## A B C ARMORED CABLE

Has These Additional Features

Which Make Installation

**EASIER — QUICKER — SAFER**



### Bond Strip Under Armor

← Permanently low armor resistance is provided in sizes No. 14 and 12 AWG by use of a flattened, bonding wire which is in contact with the under side of each convolution.

### Prefabricated Break Lines

← The Cut Mark (at 1½" intervals) shows the location of a prefabricated breaking line inside the armor. Only a few strokes of a file or saw guided by the Cut Mark are required to cut through one outer ridge, and a bend by hand severs the armor. This results in a clean separation with no sharp edge—a safer, easier and faster job. The prefabricated breaking lines are so designed that there is no reduction in tensile strength, bending quality, crushing resistance and electrical conductivity of armor.

*In the last 24 years alone, over SEVEN BILLION FEET of Armored Cable have been produced by the industry. Armored Cable provides the only general purpose, factory-assembled and tested, metal protected wiring system.*



FILE OR SAW



BREAK



PULL OUT PAPER



INSERT BUSHING

## CRESCENT WIRE & CABLE

**CRESCENT INSULATED WIRE & CABLE CO.**

TRENTON, N. J.





# TEMPERED FOR STRENGTH!

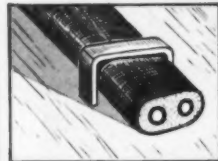
Immediately available! NEW, LOWER PRICES!



Rex Staples will not bend—even when driven into hardest woods. Points are sharp and even . . . staples start easily, drive true.



Special Rex E-Z Drive Staples have round legs for easy driving, and a flat top to prevent staple from biting into insulation.



Rex line always "up to the minute" in latest developments. For example, this T-Type Staple was on the market within a very short time after the introduction of T-Type cable!



You'll like the sturdy, easy-to-handle packages of Rex Staples—and the low prices, too!

## TITCHENER CABLE **REX** STAPLES "The Complete Line"



ROMEX  
Item 202



E-Z DRIVE REGULAR  
Item 205



EXTRA-HEAVY BX  
Item 206



T-TYPE  
Item 201



E-Z DRIVE ROMEX  
Item 203



REGULAR BX  
Item 204

(Above pictures are all Full Scale)

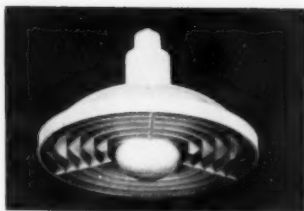
SEE YOUR WHOLESALER. Chances are he carries the complete line of high-quality Rex Cable Staples—all types, all sizes—at prices that add up to substantial savings for you!



**FREE TRIAL OFFER.** Send for free samples of Rex Staples. Then test them yourself. See how easily they start—how easily they drive home, without bending. Let your own tests prove that Rex Staples are the better buy—cost-wise and performance-wise! Write today.

**E. H. TITCHENER & CO.**  
115 Clinton St. Binghamton, N. Y.

Manufacturers of Staples and Wire Parts for Over 65 Years



Floodlight Fixture (20)

A new portable spot or floodlight fixture designed for use in any porcelain ceiling receptacle and with swiveling devices. Known as the Silver-spot adapter, the unit makes use of the new 100-watt A-21 silvered-bowl lamp. It is suitable to a wide variety of display and accent lighting uses in stores, specialty shops, restaurants, clubs, and similar commercial interiors. Equipped with a porcelain "screw-in" base, it can be used in any existing porcelain receptacle in ceilings for downlight or in walls for side lighting effects. When used in conjunction with portable base, clamp-on, screw-in, or box plate swiveling adapter fittings, the adapter is adjustable to many directional lighting applications. Unit consists of a porcelain adapter receptacle, aluminum reflector and concentric louver.

Silveray Lighting, Inc., 100 West Main St., Bound Brook, N. J.

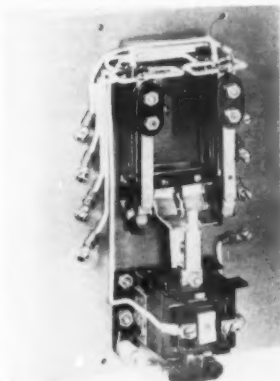


Switch (21)

A snap-action switch designed for high-precision performance in cam actuated service. It has the capacity to make or break steady state currents of 20 amperes and to handle inrush currents as high as 75 amperes. The new design has a roller plunger actuator adapted to operation by cams with a rise of up to 30°. Plunger assembly can be turned to any position necessary to align its roller with the direction of cam approach. A nut is then tightened down, clamping plunger assembly in position. The aluminum enclosure is designed to protect the basic switch against damage from vibration and shock, and the cover is sealed against dust, dirt, oil and moisture. There are

three  $\frac{1}{4}$  inch holes in a flange at the back of enclosure for mounting. Underwriters' Laboratories list these switches as  $\frac{1}{2}$  hp, 115 volts ac;  $1\frac{1}{2}$  hp, 230 volts ac; 20 amp, 125, 250, or 460 volts ac; 10 amp, 125 volts ac "L";  $\frac{1}{2}$  amp, 125 volts dc;  $\frac{1}{4}$  amp, 250 volts dc.

*Micro Switch, Freeport, Illinois*



#### Alternators

(22)

Autocon alternators automatically transpose starting sequence of any two pumps, compressors, blowers, burners, or units controlled by magnetic starters or two wire circuits. They also provide locked-in stand-by protection against a failure of the operating equipment, against failure of the pilot device, and against failure of the alternator unit itself. They are used in sewage systems, industrial processing systems, manufacturing plants, oil refineries, etc. They are designed for quick and easy installation. Connect pilot devices to the clearly numbered terminals and the unit is ready for operation. Conveniently located knockouts and conduits provide ready access to all terminals. They can be built in as integral parts of all Autocon multi-pump liquid level and pressure control panels.

*Automatic Control Company, St. Paul 4, Minn.*

#### Time Switches

(23)

The Inter-Matic time switch line now includes Series TS66 "Skipper" time switches. They are designed for control applications where it is desired to skip operation of time switch on Saturdays, Sundays, holidays, or other selected days. Operation of switch can be skipped on one or more days of the week. Available in single pole, double pole, and double throw models. A special model, with separate terminals for connecting the timing motor, is provided for independent switching.

## DON'T GAMBLE!



**Prolong Insulation Life with ELECTRO'S SuperSeven**

*Electro's improved method of processing Fiberglass increases the life of Class "B" insulation. Check the seven super features of*

**ELECTRO GLASS VAR**

- ✓ Improved thermal endurance
- ✓ High dielectric strength
- ✓ Excellent thermal conductivity
- ✓ Top tensile strength
- ✓ Rot repellent
- ✓ Resists chemicals and acids
- ✓ Good moisture resistance

GLASS VAR is available in rolls, sheets and tape.

### ELECTRO



### TECHNICAL PRODUCTS

You will find these other Class "B" Electro products tops in quality and performance

**VARNISHED ASBESTOS CLOTH**

**VARNISHED QUINORGO ASBESTOS PAPER**

**QUIN-GLASS HI-TEMPERATURE INSULATION**

Electrical equipment manufacturers are invited to use our Special Service facilities. Write or phone and we'll be glad to help you with your problem and send you technical data, samples, etc.

*You may buy with confidence when you buy*

### ELECTRO-TECHNICAL PRODUCTS

DIVISION OF SUN CHEMICAL CORPORATION

**NUTLEY 10, NEW JERSEY**

\*T. M. Reg. U. S. Pat. Off. by Owens Corning Fiberglas Corp.

*A Twist of the Wrist*  
and  
**IT'S LOCKED!**

**NEW**

**Turn-Tyte**

**INTERLOCKING  
DEVICES**

by **RODALE**

Got a wire connection problem on industrial equipment? New **TURN-TYTE** Cord Connectors, Caps and Receptacles are your answer!

**YOU SAVE TIME!**



**Slight turn locks them TIGHT!**

**TURN-TYTE 2-Wire Armored Cord Connector Body.** Two pieces of molded bakelite, with armored base and cord clamp. Bronze contacts coated to resist rust and corrosion. Available in 10-15 amps (#2100) and 20 amps (#2200).

**YOU SAVE MONEY!**



**...they're fully INTERCHANGEABLE with other makes!**

**TURN-TYTE 2 Wire Armored Cap** with cord clamp. Bakelite with brass blades. Available in 10-15 amps (#1206) and 20 amps (#1226).

**SOLD ONLY THROUGH  
LEADING WHOLESALERS**

If your wholesalers cannot furnish you with **TURN-TYTE** devices, we will be pleased to send a new catalog and names of suppliers in your area who can fill all your **RODALE** needs.

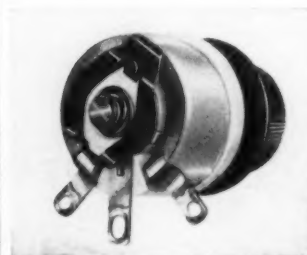
Also Available: 3-Wire, Polarized and Grounded, 10-15 Amps and 20 Amps.  
**IMMEDIATE DELIVERY!**

**RODALE**  
**MANUFACTURING CO., INC.**  
EMMAUS PENNSYLVANIA



Switches are recommended for automatic control of neon signs, lighting, pumps, blowers, motors, fans, etc. Also for automatic preheating of lead, glue, and melting pots, kilns, etc. The "Skipper" has two dials—a time dial and a day dial. Every 24 hours, a special "cutout" tripper rotates the day dial to the next day position. Equipped with manual control and automatic reset. They are rated 35 amperes at 125 volts. Minimum "on" or "off" time 1 hour; maximum 23 hours. Approved by Underwriters Laboratories.

International Register Company,  
2624 W. Washington Blvd., Chicago  
12, Ill.



**Rheostat**

**(24)**

The new version of type A-25 rheostat (25 watt) is built to withstand rugged treatment under the most adverse conditions. It has an added safety factor by the use of high temperature gray enamel. The terminals made of a corrosion resistant alloy are permanently welded to the winding form. Wire is wound on a toroidal ceramic form and the wire to terminal is securely bonded to eliminate connections. The wound ring is made an integral part of the refractory base by vitreous enamel. The actuating arm, made of phosphor bronze to which is attached a graphite brush, gives smooth action with electrical control. Shafts are insulated from all live parts by means of a shaft insulator.

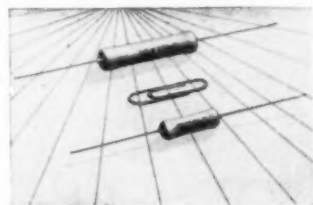
Hardwick, Hindle, Inc., Newark 5,  
N. J.

**Rectifiers**

**(25)**

A new line of high powered, oil immersed, selenium rectifiers, designed especially for electrolytic and electrochemical applications. Transformers and rectifier stacks are completely sealed in oil, therefore free from deterioration caused by corrosive atmosphere. Unit operates three 40 kw electrolytic melting furnaces. It has an output of 3000 amps with voltage adjustable from 10 to 40 volts. Dimensions are 78 inches high, 84 inches long, and 29 inches deep. Other sizes in different voltage and current combinations are available.

Electronic Rectifier Company, Rochester, N. Y.

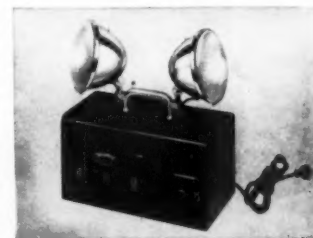


**Resistors**

**(26)**

New miniature power type resistors with axial leads, called Axiohm. They are designed for use in radio, electronic and other equipment where space saving and minimum assembly costs are essential. They are made with special alloy resistance wire of low temperature coefficient of resistivity wound on tough miniature ceramic cores. Entire assembly is encased in Vitrohm enamel forming a hard, heat conducting hermetic seal. Resistors are available in 5 and 10 watt sizes. A wide range of resistance values is available. Standard resistance tolerance is plus or minus 5%.

Ward Leonard Electric Co., Mount Vernon, N. Y.



**Emergency**

**(27)**

The battery of the new Big Beam automatic emergency light is charged to capacity at all times by an enclosed

**THE OLD WAY:**  
*strong contrast*  
*deep shadows*



**the**  
**GUTH WYTE-LINER WAY:**  
*low contrast*  
*soft shadows*



Here's a new idea in factory lighting to lift the eyestraining gloom off the ceiling:

**ALL WHITE INSIDE**—to reflect maximum light down and outward onto the working area.

**ALL WHITE OUTSIDE**—to reflect room light upward, brighten the ceiling and soften brightness contrast.

Easier to clean—reduces maintenance. Air-flow Channel circulates air currents for longer ballast life.

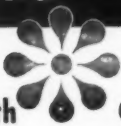
GUTH Wyte-Liners are made in 2 and 3 lamp sizes for conventional 40-watt lamps and for 4- and 8-ft. Slimline. May we send you our 16-page Catalog 48-A with complete details?

**Guth** **LIGHTING**

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

*Leaders in Lighting since 1902*

# Unsurpassed for Quality

with  choice of materials

underwriters' acceptance  
dependable service

design and workmanship

\*For McGill guards the handles, sockets, cages and miscellaneous parts are carefully selected for their resistance to the wear and abuse of rugged usage and their ability to stand up longer under the most exacting conditions. Important among the new McGill materials is impact resisting molded phenolic for handles — the same material as used in your telephone. Be sure to specify McGill guards for your safety and convenience because McGill is always first with portable lighting improvements.

Available from your electrical wholesaler



No. 7000 SR has rubber handle with strain relief and cord seal, Levolver switch. Electrically welded heavy steel wire cages, zinc plated, 100 watt cage. Open end cage 7001 SR. Hardwood handle 8000 SR. Write for Catalog No. 49.

No. 157-C  
Lamp  
Changer



No. 5000 SRG  
Grounded

No. 7000 SR  
Reflector and Switch



No. 5025 SLR  
With End Lens



No. 3006  
Vaporproof

Underwriters' Laboratories Inc., Inspected

ONLY MCGILL  
MAKES *Levolver*  
SWITCHES

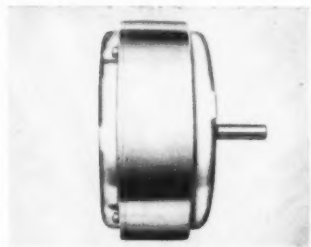
MCGILL®

electrical  
specialties

McGILL Manufacturing Co., Inc., 450 N. Campbell St., Valparaiso, Indiana

automatic trickle charger. Model 2ATW, provided instant automatic floodlighting for a minimum of four hours in the event of regular lighting power failure. The new, two-head Big Beam has been designed for use in theaters, public buildings, etc. An enclosed relay automatically turns emergency lights "on" when regular current fails, and "off" when current is restored. Power is furnished by a 3-cell, 22-ampere-hour capacity, spillproof storage battery with built-in specific gravity indicators.

U-C Lite Manufacturing Co., 1050 West Hubbard St., Chicago 22, Ill.



Motor

(28)

This new motor features a short overall length and is suited to applications requiring a totally enclosed, air cooled unit with a flat design. It is available in ratings from 1/20th through 5 hp and in speeds from 450 to 3,600 rpm—single phase or polyphase. Frame design permits mounting (1) by means of "ears", (2) drilled and tapped holes in endbells, or (3) by any other special requirement of the user. Can also be mounted in any position, shaft up or down. When mounted in this manner, fan can be connected directly to motor's output shaft, eliminating usual pulleys, belts, brackets and fan shaft. They are available in a wide number of frame sizes.

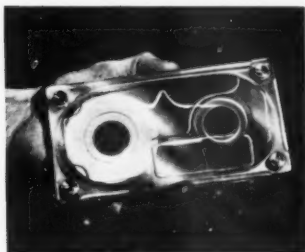
Reuland Electric Company, Alhambra, Calif.

Recorder

(29)

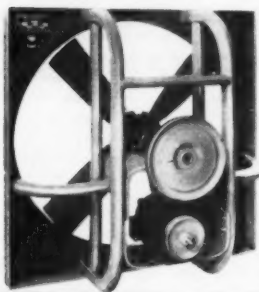
A new pocket-sized recorder makes possible monitoring and obtaining definite information in many fields where never before possible. Recorders can be set up to cover the variable factors in traffic, time and motion study, punch press operation, opening and closing of doors or windows, duration of current flow, stresses and strains, cash register history, etc. It records on a new supersensitive direct recording paper known as Alfax. Plug recorder into a 110 volt source, connect with a microswitch to whatever you wish to monitor and you get a permanent





record of two actions plus the time the action took place. Magazine is light weight and compact. Basically the recorder is made up of the magazine and driving unit. Magazine is self-contained, consisting of recording electrodes, timing switch and paper reels. Driving unit contains a synchronous motor with a pinion gear to engage and drive one of the paper reels.

*Alden Electronic and Impulse Recording Equipment Co., Westboro, Mass.*



**Pressure Fan (30)**

A heavy duty belt driven fan for industrial applications, duct work, mine exhaust systems and filtering units where large volume of air is required under static pressure. It is equipped with non-overloading cast aluminum airfoil type propellers. These units are completely ball bearing and motors are totally enclosed. Units available in sizes from 24 inches to 48 inches and air deliveries from 5,000 to 28,000 cubic feet per minute.

*Chelsea Fan & Blower Co., Inc., Plainfield, N. J.*

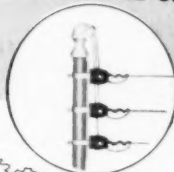
**Tester (31)**

A newly-developed, portable electronic winding tester that can detect a single shorted turn of No. 40 AWG wire. Instrument is designed to detect faults in and to prevent breakdowns of electrical motors and generators of all sizes and types, coils, and similar elec-

**It's new!**

# PIPE MOUNTING HOUSE BRACKETS

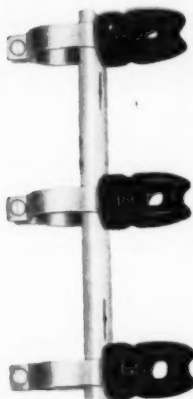
**NO MORE FUSSING OR FUMING  
NO MORE MAKE-SHIFT ARRANGEMENTS**



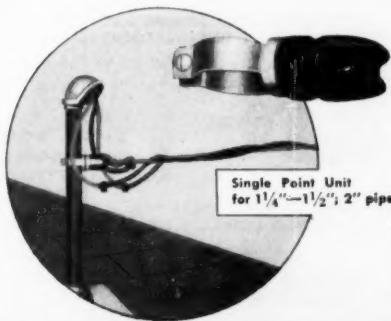
(PATENTS APPLIED FOR)



Here's just what you've wanted all along. Porcelain Products offers you the *first* easily attached, low priced Pipe Mounting House Bracket for use wherever you fasten electrical conductors to pipe. They're perfect for residential, industrial or rural wiring jobs... ideal for ranch type housing with wide eaves. Save time..money.. avoid costly delays. Write for prices, literature.



Three Point Unit 4 1/2" or 6" wire spacing, for 2" and 2 1/2" pipe



Single Point Unit for 1 1/4"-1 1/2", 2" pipe



**Porcelain Products, Inc.**  
FINDLAY, OHIO

## MARTINDALE GROWLERS

PORTABLE  
GROWLER  
TYPE U-2



This Universal Adjustable Growler may be used as both an external Growler for armatures and an internal Growler for stators. It will test armatures from 2" diameter up, and stators from 5 1/4" diameter up.



ADJUSTABLE  
BENCH  
GROWLER

Has adjustable jaws with face length of 2 1/2". With jaws closed will test armatures as small as 1" diameter. With jaws open, will accommodate armatures as large as 18" diameter.

Both types available with or without meters. Also six other models.

MARTINDALE WHEEL  
AND GEAR PULLER



Adjustable arms pull straight without squeezing the work. Set screws prevent spreading.

Made in 2 Styles and 4 Sizes up to 24" diameter.

MARTINDALE COMMSTONES AND  
COMMUTATOR GRINDING TOOLS



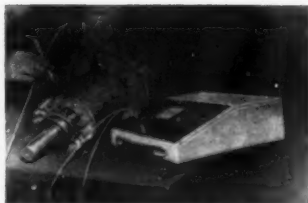
MICA UNDERCUTTERS FOR  
SLOTING COMMUTATORS



Nine Motor Driven Types

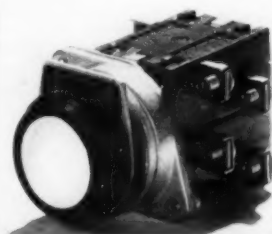
Write for 64-page Catalog describing these and many other products for Industrial Maintenance, Safety and Production.

**MARTINDALE ELECTRIC CO.**  
1309 Hird Ave. Cleveland 7, Ohio



trical equipment. Known as the PMD tester, it enables the user to detect the location as well as the nature of an electrical fault in any type of winding. It can be used on both ac and dc devices. Motor tester consists of a power supply unit, a vacuum tube oscillator, a regulator and rectifier circuit, equipped with standard tubes, and full-view, calibrated meter. Rod-like, single probes are used to test distributed windings. Field coils and squirrel cage rotors are tested with double probes.

Columbia Technical Corporation, 5 East 57th St., New York 22, N. Y.



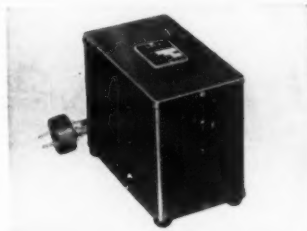
**Pushbuttons**

(32)

A number of advanced design features are incorporated in a new line of oil-tight pushbutton units for machine tool applications. The units, designed completely on the building-block principle, feature "self-a-line" contacts and removable color rings for pushbutton identification. Building-block construction provides increased flexibility of application because basic units can be arranged in various combinations to meet all special as well as standard requirements. Coding of pushbuttons with the new color rings—available in brilliant, permanent shades of black, red, green, yellow, and white—is accomplished by screwing the ring onto the neutral-colored button. New "self-a-line" double-break contacts are placed at an angle so they close with a rolling action. Only one basic form of contact block is used in the new units—a single-pole, double-throw type made of Melamine for maximum arc resistance. Double-pole, double-throw combinations are made by mounting two of these units on the same base. Although operators are mounted in

cover of enclosure, contact blocks are located on the back. Operator types available for new units include standard pushbutton, extra-long pushbutton, mushroom-head button, six forms of selector switches, two forms of combination units, padlock unit, and cylinder lock unit.

General Electric Company, Schenectady 5, N. Y.



**Voltage Booster**

(33)

A new automatic voltage booster has been developed. It is designed primarily for such motor-operated appliances as refrigerators, air-conditioners, pumps, milking machines, separators, beverage dispensers, etc. It uses the "Sensivolt" voltage sensitive ac control. If line voltage drops to about 105 volts or below, booster is automatically connected into circuit. When line voltage rises to about 110 volts or more, booster is automatically disconnected. Booster plugs into regular line outlet and motor power cord into booster socket.

Sola Electric Company, 4633 West 16th Street, Chicago 50, Ill.

**Relays**

(34)

Ameriprite delay relays are now available in the miniature T6-1/2 bulb-base 9 pin miniature. Tubes can be supplied for all standard heater voltages, such as 6.3—26 and 115 volt. Delays available from 2 to 90 seconds. Wattage consumed by heater is approximately 2 watts. Ambient compensated for temperatures from minus 50 to plus 70°C. Hermetically sealed, they are not affected by altitude or any other climatic conditions. Rugged construction enables them to withstand vibrations.

Ameriprite Company, Inc., 561 Broadway, New York 12, N. Y.

**Connector**

(35)

A complete line of new light-weight electrical connectors. They are designed to resist corrosion, vibration and effects of extremely high tempera-



**"tire-tread" TOUGHNESS**

**"snake-like" FLEXIBILITY**

**COMBINED IN**

**"MOLD-CURED" HAZACORDS**

**FOR LONGER LIFE . . .**

**LOWER CORD COSTS FOR YOU**

You've probably found it true too, that the service life of portable cords and cables — the true measure of cable economy — depends primarily on the toughness, lasting qualities and flexibility of the sheath. Today's Hazacords are the result of many years of Hazard and Okonite experience in developing portable cable and cords for unusually severe service in every type of industry.

Every Hazacord is protected with the specially developed Hazaprene ZBF Sheath. It's cured under pressure in a continuous metal mold which assures optimum vulcanization, maximum density, lasting toughness, a smooth, wear-resisting surface — and at the same time, ample flexibility is maintained. The Hazaprene

ZBF Sheath is a time-proved neoprene compound with maximum resistance to oils, acids, chemicals, moisture and weather. In addition, it is highly flame-resistant — more than meets the flame test requirements of the Federal Bureau of Mines and the Pennsylvania Department of Mines. All Hazacords are insulated with tough, heat-resisting, long-aging rubber compound for full electrical protection.

It will pay you to get all the facts about Hazacord. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

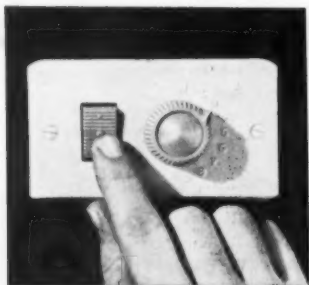


THE METAL MOLD CURE "MAKES THE DIFFERENCE"

**HAZARD**

**H**

# Cut copper requirements



**MASTER SELECTOR SWITCH** permits flexible control of large areas of lighting from central locations—can be used for watchmen's circuits and standard lighting control.



**ADDED COPPER SAVINGS** are accomplished by this small, lightweight control wire used with the G-E remote-control wiring system. Wires can be laid up on partitions, can be rerouted easily at any time.



**REMOTE-CONTROL RELAY** operates on 24 volts. Rated  $\frac{1}{3}$  hp; 15 amp; 125 volts; 5 amp, 277 volts. No need for derating with fluorescent loads.

# with 277-volt lighting

Two important ideas in wiring now offer more light with less copper.

These two ideas (1) the G-E remote-control wiring system and (2) 277-volt fluorescent lighting, can actually help you reduce the copper requirement for a given lighting load or let you offer extra lighting with a given amount of copper—and here's how:

## 277-VOLT WIRING SYSTEM

By using 480Y/277-volt distribution for lighting, you get the copper-saving advantages of higher-voltage, lower-current distribution. This voltage is provided by the standard 480-volt, 3-phase, 4-wire system, which offers a line-to-ground voltage of 277. Standard fluorescent fixtures with 280-volt ballasts can be connected directly into this system with no extra preparation.

## G-E REMOTE-CONTROL WIRING

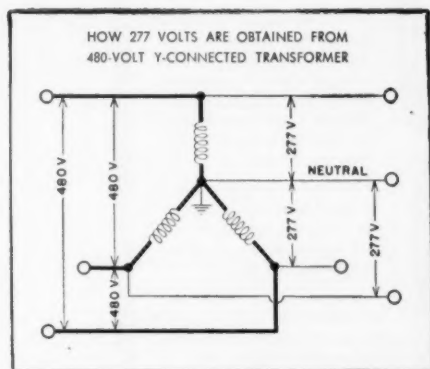
Master selector switch RMS-2 and other components of the G-E remote-control wiring system offer convenient switching of as many as nine circuits, save copper by using small 24-volt control wires. Remote-control relay RR-2 mounts in knockout box or ganged in pull box near lighting fixture—switches can be installed at any convenient location.

Individual switches and master selector switches offer the advantages of multipoint switching—in spite of today's tight copper supply.

Investigate the 277-volt lighting system and G-E remote control. Write today for a copy of *G-E Remote-Control Manual of Layout and Installation*. Section D33-618, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.



With the 277-volt lighting system, you use standard fluorescent fixtures, standard lamps. Just specify 240-, 280-volt ballasts.



Voltage between line and ground is 277 in standard 480-volt, 3-phase, 4-wire system.

*You can put your confidence in—*

**GENERAL  ELECTRIC**



# PLIERS THAT OIL THEMSELVES!



UTICA's Lubring line of pliers—the very finest you can buy anywhere—is engineered for men to whom pliers are important. They're drop forged, precision-machined—and cutting edges are induction hardened by a special UTICA process.

Each UTICA "Lubring" pliers has a ring of porous iron floating in the joint. This ring serves as a tiny reservoir for oil and releases it to the joint as it's needed.

In these days of limited replacements, why not make sure you get the long life and quality that go with UTICA?

## UTICA Drop Forge & Tool Corp.

Utica 4, New York

In Canada:

Adlam Tool & Supply Co., Ltd., Montreal  
Wells-Irons, Ltd., Winnipeg



AND THE WORLD'S BEST TOOLS ARE MADE IN U. S. A.

tures. Connectors permit unlimited wiring arrangements. The basic designs of the connectors permit its use for all AN applications with retention of its high performance characteristics. Connector will be furnished in 17 shell sizes, conforming to AN size 8-36 inclusive, and can be furnished for cord connections, shielded assemblies, and bulkhead or box mountings.

Titeflex, Inc., Newark, N. J.

## Product Briefs

(36) Industrial Engineered Products Company of Los Angeles, Calif., has introduced a new heavy Bazooka torch, with a self-cooled adjustable pistol grip handle. . . . (37) A new self-contained Dustport dust collector especially designed for remotely located individual dust sources, has been announced by Agat-Detroit Co., Ann Arbor, Mich. . . . (38) The Manco Mfg Company of Bradley, Ill., has developed two new cutting tools—the Mill Type bolt cutter with reversible jaws and the Guillotine hand operated hydraulic cutter.

(39) A new portable electric saw, named Maxaw 700, which makes all cuts in 2-inch dressed lumber at a 45° bevel cut, has been announced by Cummins Industrials, division of Cummins-Chicago Corp., Chicago, Ill. . . . (40) Tweco Products Company, Wichita, Kansas, has developed a new Model A-732 Twecotong electrode holder. . . . (41) A new hermetically-sealed transformer with cast-permafil construction for use in radar and other military electronic equipment has been introduced by General Electric Company, Schenectady, N. Y.

(42) Labelon Tape Co., Inc., Rochester, N. Y., has developed a new pressure sensitive plastic labeling tape that sticks firmly to crackle finish. . . . (43) A new receiver for measurement and control of flow and liquid level has been developed by Brown Instruments Division, Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. . . . (44) New distribution transformers with high-voltage, tank-wall bushings, instead of high-voltage, pocket-type bushings, have been announced by General Electric Company, Schenectady, N. Y.

(45) University Loudspeakers Incorporated, White Plains, N. Y., has introduced a new heavy duty PA driver unit with self-contained line matching transformer. . . . (46) Pushbutton operated instrument, designated as Vibrotest Model 267, has been developed to measure electrical resistance of conductive flooring by Associated Research, Incorporated, Chicago, Ill. . . . (47) A portable surface-resistance indicator, designed to help produce a better resistance welding bond by providing a rapid and accurate measurement of the resistance between pieces of metal to be welded, has been announced by General Electric Co., Schenectady, N. Y.

## CATALOGS and BULLETINS

(48) ELECTRICAL TAPES are illustrated and described in 16-page catalog covering features and uses of thirteen electrical tapes, tabulated data on properties and information on sizes and packaging. Insulation Manufacturers Corp.

(49) SWITCHGEAR is the subject of 12-page catalog, illustrating and describing low voltage and medium voltage capacity control equipment, including switchboards, control panels, distribution panels and voltage regulators for all types of industrial, marine, pipeline and electric set control. Electric Service Engineering Company.

(50) MERCURY PLUNGER RELAYS for street lighting control are illustrated and described in catalog 17, including complete electrical and mechanical specifications on the units up to 30 amperes capacity and installation and wiring details. H-B Instrument Company.

(51) LIGHTING SPECIFICATIONS for industrial lighting units are contained in the 1952 edition of this specification, including illustrated technical data on industrial lighting equipment, tabulated coefficients of utilization, lighting distribution curves and replicas of reflector contours, wattage standards for Slimline fluorescent lamps, and new data on specifications for high bay industrial installations. RLM Standards Institute.

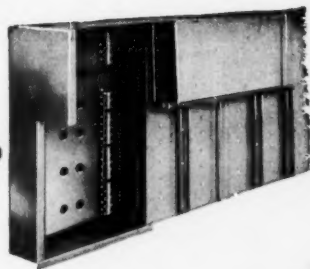
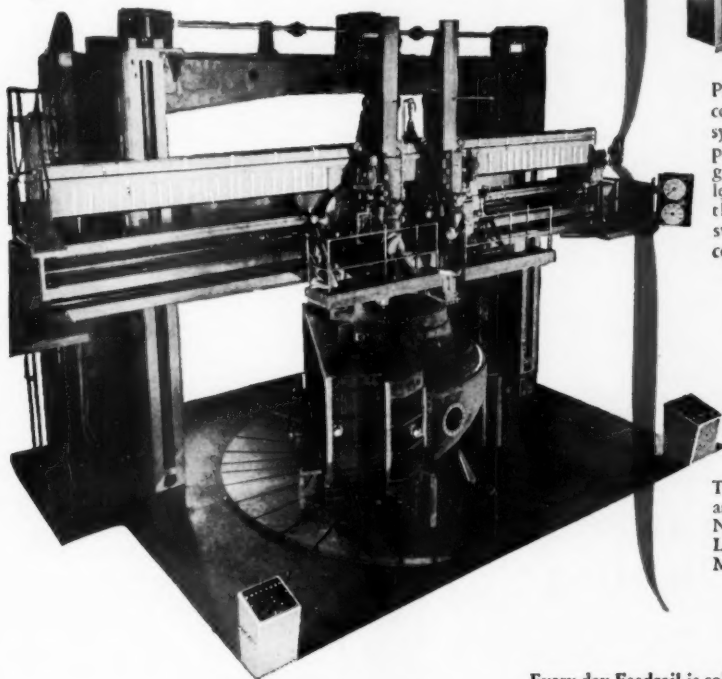
(52) CAPACITORS for power-factor correction are illustrated and described in four sections in catalog 27, covering general data on power-factor correction, applications of rack- and pole-type capacitors and specifications on types for most standard indoor, outdoor and high voltage applications. John E. Fast & Company.

(53) MOTORPUMPS for air conditioning are described in bulletin illustrating their types and uses, including typical installations on air conditioning service, sectional views showing construction and parts and complete data on the uses and rating of each type. Ingersoll-Rand Company.

(54) ELECTRICAL INSULATIONS are illustrated, described and specified in 96-page catalog, including insulating cloths, paper, tapes, varnish, lacquers, tubing, wedges, washers, sleeveings, wires, compounds, glass insulations, fibres, enamels and many other insulations. Brownell Distributors, Inc.

# ELECTRIC FEEDRAIL®

*"Nerves" for a 30-ft. giant*



Partial view of 79 pole, multiple conductor Feedrail trolley busway system that distributes current for power and control of this 30-ft. giant mill. Except for critical hand lever adjustments, all control is through buttons and selector switches located in remote dual console stations.

This huge thirty foot vertical boring and turning mill was built by the Niles Tool Works Div., Baldwin-Lima-Hamilton for Allis-Chalmers Mfg. Co.

Giant thirty foot boring mills are not built every day. When they are, precision control is essential. A 79 pole multiple conductor Feedrail provides the "nerve system" for finger-tip control and dependable, unfailing power supply for this massive machine.

Every day Feedrail is solving power and control problems. Moving trolley outlets in an enclosed track roll with electric tools which must follow work. Power machines move in and out of work centers quickly, and produce more work in less time. Feedrail flexibility is engineered into standardized units that assemble to give a "tailored to fit" power supply system. Write for literature.

Sold by leading electrical distributors.

46-C



*Never Becomes Obsolete*

## FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

125 BARCLAY STREET • NEW YORK 7, N. Y.

# HEVI DUTY TRANSFORMERS

## for power distribution and lighting

These Hevi Duty dry type transformers are installed in the new casting cleaning plant of the Bucyrus-Erie Company of South Milwaukee, Wisconsin. They are designed and built to provide many years of dependable service under adverse conditions.

For more information about Hevi Duty dry type transformers write for  
Bulletin HD-499.

**HEVI DUTY ELECTRIC COMPANY**

HEAT TREATING FURNACES **HEVI-DUTY** ELECTRIC EXCLUSIVELY

DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS

**MILWAUKEE 1, WISCONSIN**

(55) **MATERIALS HANDLING** techniques are illustrated and described in picture-caption sheets in a folder, including descriptive accounts of handling materials in eleven major industrial classifications. The Yale & Towne Mfg. Company.

(56) **LIGHTING UNITS**, exit and directional lights and the line of cast protected vaportight lighting units, are illustrated and described in bulletin. McPhilben Mfg. Co., Inc.

(57) **LIGHTING SPECIALTIES** are illustrated and described in bulletin 600, including all-metal fluorescent desk lamp, fluorescent kitchen fixtures, all-steel portable fluorescent local light, fluorescent chrome brackets with or without adjustable metal reflector shield, accent lighting units, adjustable spot lights and color lens kits. Mitchell Mfg. Company.

(58) **LIGHTING MANUAL** is a 32-page technical manual illustrating and describing a complete line of luminaires, accessories and replacement parts, including photometric and other technical data on the commercial and industrial lighting equipment. Wm. Penn Fluorescent Light Mfg. Co.

(59) **LIGHTING TRANSFORMERS** for mercury vapor lamps are illustrated and described in 16-page bulletin 521-5, covering indoor types (single and two lamp) and outdoor types (multiple and series circuit) for the operation of H-1 400-watt mercury lamps, actual installations, wiring diagrams, mounting, starting and technical data. Jefferson Electric Company.

(60) **WIRING DEVICES** and electrical specialties are illustrated and described with technical data in 36-page catalog, including convenience outlets, receptacles, switches, plug cord sets, extension cords, wall plates, plugs and cube taps, adapters, pushbuttons, etc. Gem Electric Mfg. Co., Inc.

(61) **SAFETY SWITCH** and plug receptacle, explosion-proof and dust-tight interlocking type, explosion-proof lighting fixtures and accessories, dust-tight and vaportight lighting fixtures, conduit fittings, group lights, explosion-proof and dust-tight circuit protector and switch, panelboards and fittings are illustrated, described and specified in catalog sheets, including 88-pages of catalog number index and prices. Appleton Electric Co.

(62) **ELECTRICAL PARTS** catalog contains 102-pages of technical data on terminal lugs, terminal boards, swagers, hardware, insulated terminals, coil forms, wound coils and electronic components, including indexed illustrated descriptions. Cambridge Thermionic Corp.

(63) **INSTRUCTION BOOK, 18X7692**, contains illustrated detailed information on switchgear, including general data, installation, inspection and testing, operation, maintenance and repair of vertical-lift metal-clad switchgear, with installation and wiring diagrams. Allis-Chalmers Mfg. Co.

(64) **OUTDOOR DISCONNECTS**, single-pole disconnecting switches, are illustrated and described in publication 5104, including illustrated technical data on these hook operated disconnecting switches in voltages from 7.5 to 161 kv, 600 and 1200 amperes. Delta-Star Electric Company.

(65) **INSULATING PAPER** is the subject of 2-color, 4-page file folder on a line of electrical insulating paper, including samples of the papers, specifications chart and complete illustrated technical data. Cottrell Paper Co.

(66) **WIRING SYSTEM** is the subject of "20 Questions and 20 Answers on Safety m.i. Wiring," a bulletin illustrating and describing the new Safety Mineral Insulated wiring, including types, sizes, weights and lengths. General Cable Corp.

(67) **CONTROL SELECTION** is the subject of bulletin GEA-5481 on the selection of motor starters, pushbutton stations, relays, limit switches, solenoids, electronic devices and other control equipment. General Electric Co.

(68) **STREET LIGHTING** engineering guide is an 84-page manual on the design of street lighting systems, including photometric charts, diagrams and illustrations, sample problems and step-by-step solutions, and information on maintenance and maintenance costs. Westinghouse Electric Corp.

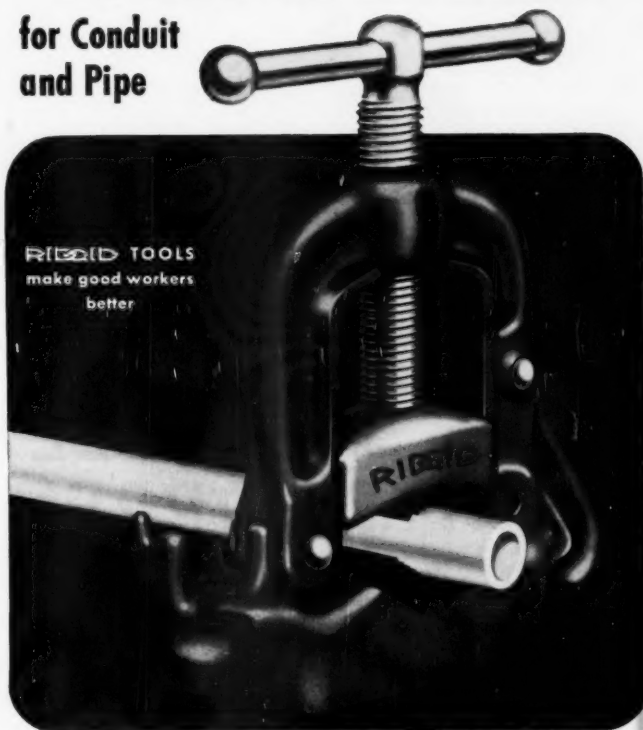
(69) **LIQUID LEVEL CONTROLS**, all-electric floatless type, are illustrated and described in 36-page manual, including principle and operation of the relay, applications of relay induction switches, signals and alarms, wiring diagrams, pump controls and control panels, specifications and prices. B/W Controller Corp.

(70) **CABLE CONVEYOR** systems for overhead materials handling methods are illustrated and described in 4-page bulletin, covering complete specifications on the cable, trolley bracket assembly and accessories. Daigle-Gaboury, Inc.

(71) **POWER FUSES**, boric acid type, are illustrated and described in booklet B-5469, including construction, ratings, operating characteristics, and applications for the type BA De-Ion boric acid fuse, the type DBA dropout fuse and the type BAL current-limiting fuse. Westinghouse Electric Corp.

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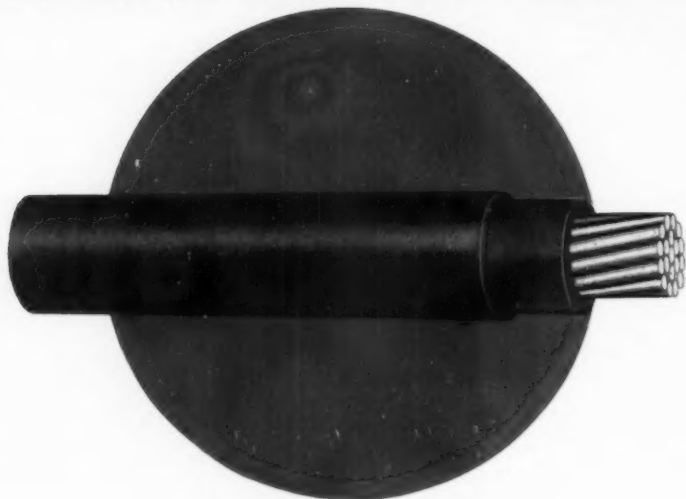
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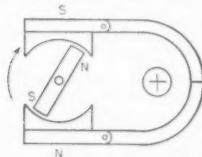
# Reader's Quiz

## Instrument

**QUESTION Q20**—*I have recently heard of a tong test direct current ammeter. On what principle does such an instrument operate?*—W.P.R.

**ANSWER TO Q20**—There is available an instrument known as the Tong Test Ammeter which can be used on both alternating current and direct current. It is a split-electro-magnet type of instrument operating on the moving iron attraction principle. The magnetic circuit consists of two equal packs of iron laminations, one of which is rigidly fixed and the other pack is hinged to the frame of the instrument. The packs are mounted to form an iron core with two gaps. One gap is a butt joint of low reluctance, the other a specially shaped gap of comparatively high reluctance in which the movement operates. The movement itself is mounted between two sapphire jewel bearings. It is contained in, and is integral with a sealed bakelite housing and is fitted with an air damping chamber. A handle and a trigger mechanism are provided, by means of which the instrument can be held and operated.—L.E.G.

**ANSWER TO Q20**—The type of ammeter you mention operates on the principle or physical law, that when a conductor carrying a current is placed near a magnetic material such as iron, the iron is magnetized causing a North pole to be formed at one end and a South at the other. If a piece of soft steel is bent in the form of a horse shoe magnet with poles as shown in



illustration, north and south poles will be created as indicated when current is flowing in the wire. The strength of these poles will be in proportion to the current flowing in the wire. If a small permanent magnet is placed within this field and pivoted so as to rotate against the force of a hairspring, and a pointer attached to its shaft, we have an ammeter. As like poles repel and unlike poles attract, there will be

rotation in the direction indicated, and its rotation will be in proportion to the strength of magnets which is in proportion to the current flowing in the wire. As the direction of the current is not generally known, the pointer may go in the wrong direction. This can be corrected by turning the meter the other way or using a center O instrument.—A.E.T.

## Rings on Commutator

**QUESTION R20**—*We have a Westinghouse generator, an old one, 150 kw, 250 volts, 600 amps, that has 3 fibre insulating rings around the commutator, one at each end and one in the center of the commutator.*

*There are four sets of brushes, six in a row, three on each side of the center fibre ring, but connected together.*

*Could someone tell me why these fibre rings are on the commutator? Would it unbalance the commutator if they were removed? The commutator is hard to keep clean because of the fibre in the center.*—A.F.L.

**ANSWER TO R20**—Commutator segments are held in position by being pinched between the V-rings at the ends of the commutator. The forces exerted by the V-rings may tend to cause a certain amount of buckling strain in the segments. When a long commutator is necessary, and more especially at high speeds, rings are placed over the commutator to resist buckling, and consequent looseness, resulting from centrifugal forces. Common practice is to shrink steel rings into place. While the designers of our older equipment were quite conservative by modern standards, in staying below the allowable working stresses of materials, one may say that the fibre rings were placed on the commutator for a purpose and should not be removed.—L.E.B.

**ANSWER TO R20**—I would suggest reading the nameplate to see what the voltage rating is. It may be a two winding armature with a common set of field poles. The two windings being connected in parallel for 250 volts and series for 500 volts. Whether this is true or not can be found only from

reading the nameplate, getting in touch with the manufacturer or removing the connection between both sets of brushes and taking voltage readings without load on generator. If it is a two winding armature it would not be advisable to remove the fibre rings if you ever expected to reconnect it for 500 volts as the commutator would not be properly insulated for use on 500 volts. If it is only going to be used on 250 volts it would be advisable to get a cross-sectional drawing of the generator or to communicate with the manufacturer to see if it was O.K. to remove the fibre rings for the fiber may also be used to keep the commutator from moving out of place.—E.B.

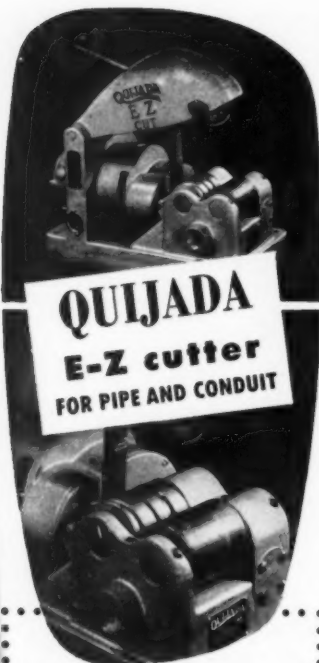
## Electric Horn

**QUESTION S20**—*How could you get more volume from a 6 volt horn? I have difficulty in exceeding the noise of Diesel shovels to give a clear signal using a 6 volt electric horn. Best results so far are by mounting on top and boxing in the long trumpet-type horns.*—E.S.H.

**ANSWER TO S20**—It is likely the volume can be increased by increasing the voltage on the horn. Check the adjustments to see that these are set for maximum volume and best tone. A higher pitched tone would be more effective in this application. Also try changing the mounting. It seems as though it would be undesirable to box in the horn—at least with rigid parts bearing against the horn itself.—R.J.S.

**ANSWER TO S20**—I have had plenty of trouble with jobs such as you have described in your problem. Have tried large bells, and horns where machinery interferes with the signal, even 115 volt horns are not very good unless quite an expensive type is used. I fail to understand why any factory cannot build a 115 volt horn for \$50 or \$75 that can exceed an old auto horn on a 6 volt battery. It all boils down to that very point, take an old automobile horn on a 6 volt lead storage battery, and it cannot be beaten for any ordinary price.—M.C.T.

**ANSWER TO S20**—It is assumed that the horn in question is operated by



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DC. If it is not, I would suggest DC operation of this horn from a DC source either from a battery or else a power unit capable of taking care of the load. If the horn is already connected to a DC source, one way of reducing voltage drop at the horn is by means of a horn relay in which the battery or DC positive lead goes directly to the relay and not to the switch which closes the circuit to give the signal. All the switch does in this circuit is to operate the relay coil and does not enter into the operation of the horn directly. In using the relay system which I have just mentioned, one end of the horn switch, the ground for the horn and the battery or DC, must be connected together. It may seem odd that the one end of the switch is also connected to the side of DC. In this case the switch merely closes the circuit to the relay coil and DOES NOT operate the horn, as I have said before. As some relays are grounded through their case it might be advisable to use a metal plate to mount the interconnected grounds, and it might be advisable to mount the relay in an accessible place so its contacts can be cleaned, adjusted and inspected at frequent intervals.—L.C.D.

### Testing Rectifiers

QUESTION T20—I would like a reliable test method to determine when sections of copper oxide or selenium rectifiers are defective before complete failure occurs, or when the direct current effectiveness is being reduced.—B.C.M.

ANSWER TO T20—Check the temperature. A shorted section will be cool. Measure the DC voltage under load. It will drop as soon as a section is shorted out on condition that the line side of the rectifier has drooping characteristics. Do not overheat any dry rectifier by reducing the ventilation, or by placing it close to a steam radiator.—H.S.

ANSWER TO T20—I believe that the best method is to test the rectifier under normal operating values of AC voltage and load or, if the load varies widely, under some load that is about average. In most cases it would be possible to do this without even momentarily disconnecting the load. Readings of AC voltage and current should be taken with the load set as stated above. A record should be kept of the readings so that a comparison can be made between identical rectifiers and between readings of the same rectifier. The ampere readings should

vary about as the volts. Readings higher or lower than normal would indicate defective cells. Allowance must be made for aging. The above is for the usual load. For battery charging the AC readings would not be conclusive. In this case it would probably be best to substitute a resistor for the test.—R.J.S.

### Electric Clock

QUESTION U20—How can a 15 inch electric clock be permanently repaired when it refuses to run whenever the temperature falls below 40°F? It must be necessary to make the repair without leaving the room, moving the clock or placing a miniature heater within the clock.—E.B.

ANSWER TO U20—Probably the simplest solution is to remove the movement and observe it at the temperature where it will not run. By checking the motor separately and checking the friction drive, it should be possible to pin down the source of the trouble in a short time. The chances are that some part is binding and when this part is located, it should not be difficult to increase the clearance. 40°F does not seem cold enough to cause trouble with the usual clock. One manufacturer uses different oil in their motors for low temperatures, but 40° would not be considered low enough for this.—P.S.

ANSWER TO U20—Evidently the lubricating oil in the sealed unit is being adversely affected by the low temperature. When the viscosity of this oil becomes too heavy, it causes the motor and gear train to run at a reduced speed and if the oil becomes too thick it will stop completely. A simple remedy is to remove this unit from the clock and file two holes in the edge spaced diametrically opposite from each other. Be careful to keep the filings out of the inside of the enclosure. When these holes are made pour all the old lubricant out. A little heat applied to the unit will cause it to flow out freely. When all the old oil is removed close one hole with solder and refill through the remaining hole. The important part is to refill with mineral oil, also known as liquid petroleum, purchased from any drug store. When this is done close the other hole with solder and reassemble the clock. Do not allow any solder or flux to enter the inside of the housing.—H.C.S.

ANSWER TO U20—All that is required to permanently repair the electric clock is to replace the oil in which

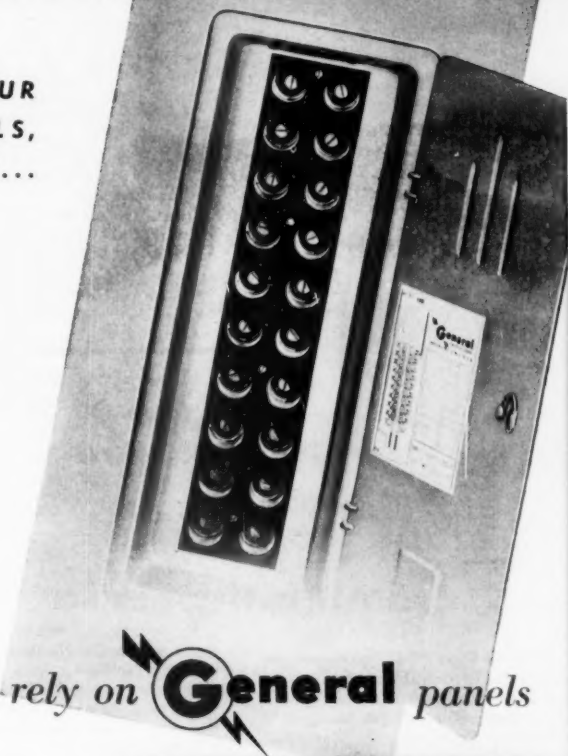


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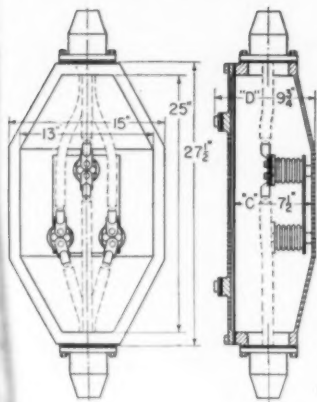
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## Can you ANSWER these QUESTIONS?

**QUESTION F21**—In wiring mills and elevators we are required to use rigid conduit and dust tight fixtures, approved for such conditions. I was under the impression the reason for rigid conduit was to have the structural strength of the falls in order to confine any explosion inside the conduit.

My question is—why are we allowed to use flexible metallic conduit (Greenfield) in connecting from this system to a motor? It would seem that this would be a very weak link and defeat the safety factor of the installation.—G.L.R.

**QUESTION G21**—What advantages are there in using a single conductor feed of ample size over a multiple of small size wire with the same total amperage rating? Wouldn't the heat dissipate much faster from smaller wires in multiple than from a single wire even though it were stranded?—E.S.H.

**QUESTION H21**—I have a generating unit which is the only supply on the system. At present the power factor is 90%. If the system power factor is raised to a higher factor, will the cost of generating power decrease and if so, by how much?—T.J.H.

**QUESTION J21**—In our plant we have a few high frequency induction heating units which, of course, use a high AC input voltage into a set of gas rectifier tubes to supply the DC

voltage for the oscillators. Now this high voltage in these circuits creates a problem as the peak AC voltage attains 15,000 volts and, if breakdown to ground occurs, we have a short-circuit as the B lead of the DC output of the rectifiers is grounded to the machine. Could anyone suggest an economical method of testing out this high voltage circuit to grounds?—E.J.K.

**QUESTION K21**—We have an induction pinion heater in one of our shops which is used to remove traction motor pinions on Diesel locomotives. It is wound with two parallel circuits of No. 6 wire, 86 turns in each circuit, and is used on a 440 volt, 60 cycle circuit. Inside diameter of coil is 12½ in., outside diameter 14½ in., width 6 in. We would like to know how we can compute the inductance of the coil, the current, and the number of turns required if the heater is rewound with a single No. 3 wire in place of the two No. 6 wires.—D.H.N.

**QUESTION L21**—We have a great many conventional oil filled distribution transformers scattered throughout our shops which have never received any attention except following actual failures. Would a program of routine inspections and oil changes improve our service? If so, what is recommended? We have never had any unusual number of transformer failures except as a result of lightning, even though many of our transformers have been in service over twenty years.—D.H.N.

**QUESTION M21**—Can I use a pressure control on a hot water boiler in order to prevent the water from flowing out when the temperature goes up too high?—H.S.

**QUESTION N21**—We have an old 6 volt DC automobile generator connected to an AC motor for charging 6 volt storage batteries in the shop. Usually just one battery is on charge at a time. This generator is one that had a voltage regulator in the circuit when it was used in a car, but does not have one now and so charges the battery at a high rate.

What size rheostat would be suitable to cut down the charging rate to about 6 amperes? The present rate without any control is as high as 40 amperes.—E.E.M.

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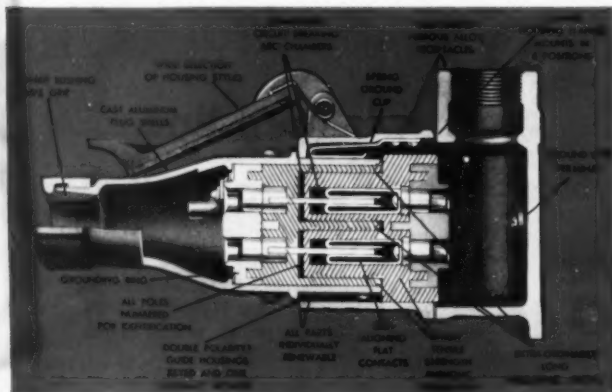
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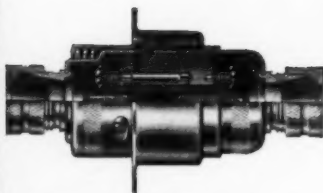
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# Questions on the Code

Answered by

**B. A. McDONALD**, New York Board of Fire Underwriters, Rochester, N. Y.

**GLENN ROWELL**, Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

**B. Z. SEGALL**, Consulting Electric Engineer, New Orleans, La.

**F. N. M. SQUIRES**, New York Board of Fire Underwriters, New York, N. Y.

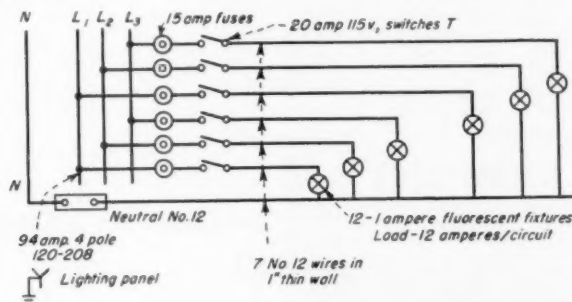
## Controller

**Q.** May a  $\frac{1}{2}$  hp 110 volt single phase motor use an attachment plug cap as both a disconnect and the controller?—A.B.

**A.** Under Section 4383, item c. you will note that a portable motor rated at  $\frac{1}{2}$  horsepower or less may use the attachment plug cap and receptacle as its controlling means, but inasmuch as no mention is made of a  $\frac{1}{2}$  hp. motor, it is necessary that we comply with item b. of this section, which states that the controller may be a general-use switch having an ampere rating at least twice the full-load current rating of the motor. Then in subsection e. of Section 4402 you will find that for portable motors an attachment plug cap and receptacle may serve as a disconnecting means. Therefore on a  $\frac{1}{2}$  hp. 110 volt single phase motor the attachment plug cap may be the disconnecting means but it is necessary that for a controller the motor must be provided with a switch having a rating at least twice the full load running current name plate rating of the motor.—G.R.

## Common Neutral—"T" Switches

**Q.** Is there any N. E. Code violation in the diagram shown below?—P.R.G.



**A.** The diagram shows two, three phase, four wire, wye connected, branch circuits with a common neutral, No. 12 in size, the same as the other branch circuit conductors. The use of a common neutral for multi-wire branch circuits is no longer recognized by the Code for interior wiring. For outside wiring, however, Section 7312 of the Code recognizes a common neutral provided not more than eight ungrounded conductors are used and further that the neutral shall have a carrying capacity not less than twice the carrying capacity of one of the ungrounded conductors. As a result of the above you could not use a common neutral as shown for interior wiring. You could use a common neutral for branch circuits when used for outside wiring, but the neutral should be of sufficient size to carry the maximum unbalanced current. In the diagram shown, assuming Type R conductors are used and are run as single conductors, overhead between poles or structures, the neutral must be capable of carrying 50 amperes. See Table No. 2.

I also note that you intend to use a 20 ampere switch for the control of a 12 ampere fluorescent lamp load, which is an inductive load. This is a violation of Section 3814c which requires a switch controlling an inductive load, to have a rating of twice the ampere rating of the load. It also appears that you are using a 115 volt switch on a 120 volt circuit. I believe, however, the type T switch has a 125 volt rating.

Assuming that the switches shown

on the diagram are installed in the panel, we have a violation of Section 3885 which requires the switch to disconnect the fuses except for service equipment.—B.A.McD.

## Four Wire, Delta Service

**Q.** A customer will require a service for 150 amperes, single phase, 120/240 volts lighting load and a continuous duty 10 hp 220 volt, three phase, squirrel cage, across-the-line started, Code letter G, 50° C rise motor. The utility company will only supply a four wire, delta, 120/240 volt, three phase service and one meter loop. What size service conductors and conduit must be installed? How must the installation be made?—A.W.

**A.** This problem can be answered in several ways. For the purpose of our discussion, a system similar to that shown in the following example will be taken as typical for such an installation.

A four wire, delta service drop feeds into a similar service entrance through a meter loop and terminated in a junction box. Immediately adjacent to the junction box we install a power switch and a light switch.

For the motor the following calculations are pertinent:

**Branch circuit protection**—10 hp, 220 volt motor, full load current equals 27 amperes. (Table 24, Chapter 10.) Maximum rating of fuses for motor,  $3 \times 27$  equals 81 amperes. (Table 26, Chapter 10.) A 100 ampere, three phase 10 hp rated main switch with three 90 ampere fuses is installed. 90 ampere fuses are the next highest rated fuses above the 81 ampere size required (Section 4349).

**Running Protection**—Assume actual current rating of the motor to be 29 amperes (this would be the actual value shown on the motor nameplate). Maximum protection equals  $1.15 \times 29$  or 33.35 amperes (Sections 4322a and modifications as per Section 4324).

**Minimum Branch Circuit Size**— $27 \times 1.25$  equals 33.75 amperes (Section 4312). Three (3) No. 8 type R,

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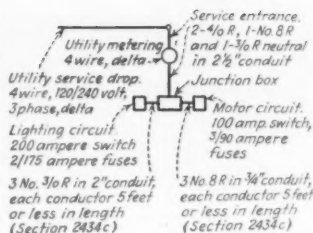
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T, RH, etc., would be required (Table 1, Chapter 10.) Minimum conduit size would be  $\frac{3}{4}$ " (Table 4, Chapter 10.)

For the lighting load a 200 ampere switch would be required with two 150 ampere fuses. Actually if this 150 ampere load would be continuous it may be found necessary to up these fuse sizes to 175 ampere size, or install time lag fuses.

For the 150 ampere load two 3/0 Type R (or two 1/0 Type RH) phase conductors (Table 1, Chapter 10) and one 3/0 Type R (Table 1, Chapter 10 and Section 2203g) or 3/0 bare neutral conductor (Section 2303a) may be installed. The minimum conduit size would be 2 inch.

The main service entrance would be designed as follows:

Motor conductor minimum size	33.75 amperes
Lighting Load	150.00 "

Combined Load 183.75 "

Minimum size of two phase conductors serving the lighting and the motor load would be 4/0 Type R.

Minimum size of third phase conductor serving the motor, only, would be No. 8 Type R.

Minimum neutral size would be 3/0 Type R.

The service entrance conduit size would be calculated as follows:

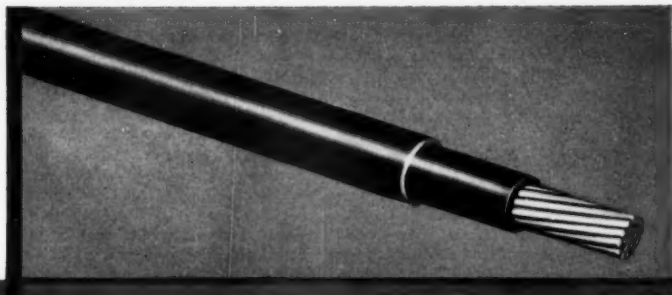
2—4/0 phase lines at .4840 sq. in. each—	9680 (Table 13)
1—3/0 neutral line at .4151 sq. in.	—4151
1—No. 8 phase line at .0760 sq. in.	—0760
	1.4591

Minimum conduit area at 40% fill (Table 11, Chapter 10) would be 1.4591/.4 equals 3.65 sq. in. The area of a 2 inch conduit is 3.36 sq. in. and that of 2  $\frac{1}{2}$  inch conduit is 4.79 sq. in. A 2  $\frac{1}{2}$  inch conduit would have to be installed.

The diagram illustrates the above.—B.Z.S.

## Electrodes For Grounding

Q. When wiring suburban property where no underground distribution water system is available,



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does a contractor comply with the code when he provides an approved type of ground rod as the grounding electrode for the neutral conductor provided, of course, it is properly driven at a point where the down spouts will bring moisture to the earth about the driven electrode? The local inspector is insisting that we use two and three 10-foot rods instead of the conventional 8-foot rod and that the rods be interconnected with the rods driven at least 6 feet apart. Does the Code actually require this?—M.R.T.

**A.** The National Electrical Code, Section 2584, states that made electrodes shall, if practicable, have a resistance to ground not to exceed 25 ohms, and if the resistance is not as low as 25 ohms, two or more electrodes connected in parallel shall be used. A contractor depending on made electrodes for grounding his neutral should in each case make some measurement to ascertain whether or not resistance to earth is reasonably low and undoubtedly in your area your inspector has found by measurement that soil conditions are such that it requires two or more rods in parallel to bring about a sufficiently low resistance. Actually, a resistance of 25 ohms is far too high inasmuch as it does not provide a low enough resistance to open overcurrent protection on 15 or 20 ampere circuits in the event of faults to earth and is therefore depending entirely on the distribution neutral to supply the resistance necessary to open such circuits. Therefore, should the distribution neutral be broken, it would be necessary to have ground electrodes having a resistance of less than 6 ohms to open a 15 ampere overcurrent protective device. —G.R.

## Fuse in Ground Circuit

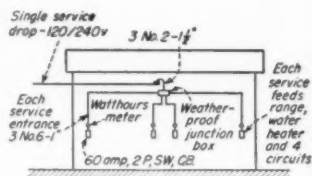
**Q.** Section 2371-b of the Code covering Services prohibits an overcurrent device to be inserted in the grounded service conductor except a circuit breaker which simultaneously opens all conductors of the circuit. Section 2409-b permits a fuse to be used in a 2-wire branch circuit when grounding connections are likely to be reversed. Is this a conflict?—A.McB.

**A.** Many of us recall the days of three wire services, feeders, and branch circuits with all conductors fused and the hazards that resulted when the fuse in the neutral blew and 230 volts was impressed on one side of the circuit. Lamps, motors, and

other devices failed. In order to eliminate this hazard the Code prohibited the use of overcurrent protection in the grounded conductor, except where the overcurrent device simultaneously opened all conductors. The Code also recognized the fact that in some locations grounding conditions are poor and reversal of polarity might result, and under such conditions the overcurrent device would be shifted to the ground wire which also may be hazardous. In order to safeguard this hazard the Code permits under such conditions to place an overcurrent device in each conductor of a 2-wire circuit. With a two wire circuit you would not get the abnormal 230 volt pressure on the circuit when the neutral fuse blew, and if the polarity was reversed you would still have protection in the live conductor. —B.A.McD.

## Service Entrance

**Q.** We are required by the Housing Administration to make an installation as shown in the following sketch:



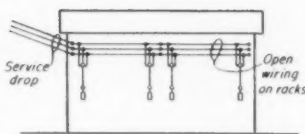
While we admit that this might comply with 2305 of the Code we believe it to be bad practice.

The transformers are connected in bank and if a failure should occur in the junction box the results would be bad.

Will you tell me what your reaction is to this?—G.R.C.

**A.** As you stated this type of construction does comply with the Code. With the proper size of junction box and with taps carefully made, there is no reason why such an installation should not give many years of reliable service.

In our own city many installations similar to this have been made in the downtown area which is served exclusively by a secondary network system. The service drop is brought in from the underground system in steel and fed into junction boxes, Types C, E and other conduit fittings before it is terminated at the various individual service switches. Some of these have been in service since 1925 and the service has been excellent with practically no failures resulting in the fittings or boxes.



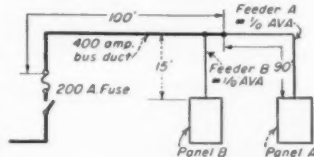
The type of installation which I tend to favor somewhat, when such an installation is feasible and can be made without violating code clearance rules, etc., is illustrated above.

In this installation, no taps are made within steel enclosures, and in addition the steel on the job is kept to a minimum. —B.Z.S.

## Busway Taps

**Q.** In a recent design of a school building, I was obliged to use one set of bus duct to supply the power to two panelboards. The bus duct terminated at a point as noted on sketch, and from this point on, it is to be taped off with two sets of feeder cables, A and B, for feeding panelboards A and B respectively. The connections of the bus duct and feeders are illustrated on the sketch.

As shown on the sketch, the 400 A. bus duct is protected by a set of 200 A. fuses. Feeder A is approximately 90 feet in length and feeder B is 15 feet. They are both No. 1/0 type AVA cables.



According to Table 1, Chapter 10 of the NEC, the allowable current carrying capacity of No. 1/0 AVA cable is 160 A. for room temp. 68° F. or below, and it reduces it to 160x.94, or 150 A. for maximum room temp. 104° F. Also, according to the Code, Article 2403, the maximum allowable rating of overcurrent protection may be up to 150% of that of the conductor, or 225 A. fuse is permitted for protecting No. 1/0 AVA cable. Now, since the fuse for bus duct is only 200 A. which is below the maximum rating permitted for the No. 1/0 AVA cable, therefore, the cable is protected against overcurrent. Here is my question. Referring to Article 2434, it states:

"Over current devices shall be located at the point where the conductor to be protected receives its supply, except as follows:

"(a) .....



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ARCHITECT: Delbert K. Perry & Associate, John Perry, New Britain, Conn.  
ELECTRICAL CONTRACTOR: Peterson Electric Co., New Britain, Conn.  
FIXTURES: 30 Special No. F74 4-lamp fixtures;  
4 Special 4-lamp corner mitred fixtures.

LAMPS: Standard warm-white fluorescent.  
AREA: 32' x 60' x 12' ceiling height — 1,920 square feet.  
WATTS: 6,500  
WATTS PER SQUARE FOOT: 3.3

AVERAGE INTENSITY ON PAINTINGS: vertical plane (outside row of lamps only) 20 footcandles in service. (With all lamps on) 32 footcandles in service.



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displays (see small photo). *Planned Lighting by Litecontrol* provided fixtures with outside lamps operating independently of inside lamps, with light shielded by a vertical baffle. Thus, the outside row alone evenly illuminates the paintings around the

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**"(b) Smaller Conductor Protected:**

If the overcurrent device protecting the larger conductors also protects the smaller conductors in accordance with Tables 1 and 2 of Chapter 10.

**"(c) .....**

**"(d) Taps Not Over 25 Feet Long:**

If the smaller conductors have a current-carrying capacity at least one-third that of the conductor from which they are supplied, and provided the tap is suitably protected from mechanical injury, is not over 25 feet long, and terminates in a single circuit breaker or set of fuses which will limit the load on the tap to that allowed by Tables 1 and 2, Chapter 10. Beyond this point the conductors may supply any number of circuit breakers or set of fuses."

My interpretation of this installation is that since the fuse for the bus duct also protects the feeder cables, it complies with paragraph (b) and therefore the overcurrent device for the cables may be omitted. However, someone argues about this point and claims that feeder "A" is 90 feet long, which is beyond the limit of 25 feet under paragraph (d), and therefore, an overcurrent device at the point of supply is required. I disagree with him. My interpretation of paragraph (d) is that this paragraph only applies to those sizes of the "smaller" conductors which have at least one-third of the capacity of the "larger" conductors but at the same time are too small to be protected by the overcurrent device of the "larger" conductor. That means, for such sizes, the overcurrent device at the supply size may also be omitted if they comply with the provisions listed, namely:

1. Not over 25 feet long, and
2. Having a set of fuses of a single circuit breaker which will limit the load on the tap to that allowed by Tables 1 and 2, Chapter 10.

Since, as I explained previously, feeder "A" is protected by the overcurrent device of the bus duct, it should not be limited by the provisions listed in paragraph (d).

I will appreciate it very much if you will give me your advice or interpretation of this problem—W.T.

**A.** Before answering your question I would like to clarify the following points: According to Table 1, Chapter 10, the allowable current carrying capacity of No. 1/0 AVA cable is 190 A; Section 2403 of the Code permits overfusing to the extent of 150% only when standard fuse sizes

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do not correspond to the conductor current capacity. In such cases the next larger size fuse may be used provided it does not exceed 150% of the current capacity of the conductor. In order to satisfy this provision a 190 amp fuse must be used if such a size is a standard rating. According to available information the 190 amp fuse is not standard and you are then at liberty to use a 200 amp fuse but not a 225 amp fuse. The 200 amp size is considered a standard rating.

In answer to your question I would say that both the 90 foot tap and the 15 foot tap protected by 200 amp fuses are correct provided you are using a No. 1/0 AVA cable with a current carrying capacity of 190 amps. If, however, the cable you are using only has a current capacity of 160 amperes, there would be a Code violation of Section 2403 and Section 2434-d. It appears to me that your opinion in this matter is influenced by the supposition that a conductor with a current carrying capacity of 160 amperes may, under any condition, be protected by a fuse rated 150% of the conductor capacity. If I have clarified this point in your mind I believe you will agree that your reasoning concerning 2434-d is incorrect.

Section 2434-d, the 25-foot tap rule, permits unprotected taps when the current capacity of the tap conductor is at least one-third that of the conductor to which it is attached; when the tap is not over 25 feet long; when the tap is protected from mechanical injury and; when the tap terminates in a single overcurrent device which will limit the load to that permitted by Tables 1 and 2. Section 2434-d is not limited to smaller conductors.

According to your diagram the 90-foot tap is a Code violation and unless Panels A and B each contained an overcurrent device rated at 160 amperes or, in the case of fuses, rated at 175 amperes there would be a Code violation.—B.A.McD.

## Circuits For Dwellings

**Q.** The number of circuits in a dwelling are determined by using three watts per square foot as is required by the Code. Is there a limitation on the number of ordinary convenience outlets which may be placed on each circuit or will the Code limit up to ten such outlets per circuit?—P.W.

**A.** Under Section 2116 of the Code, you will find the following statement: "All receptacle outlets of 15-ampere or less rating in single-

family and multi-family dwellings and in guest rooms of hotels (except those connected to the receptacle circuits specified in paragraph b. of Section 2115) may be considered as outlets for general illumination, and no additional load need be included for such outlets."

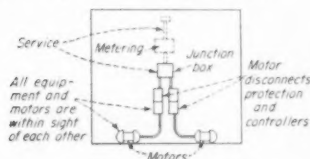
Therefore, if for convenience purposes one wishes to place outlets every few feet around the perimeter of a living room, for instance, the Code will not limit the number of such outlets on any one circuit. It would, of course, be advantageous to have at least a division of circuits supplying an individual living room and many contractors divide the outlets in a living room between two or more circuits which may also extend to other portions of the dwelling and do whenever a serious attempt is made to balance load.

You will also note under item 3, subparagraph c. of this same section that even where multi-outlet assemblies are utilized in dwellings there is no limitation placed upon the length of such assembly which may be connected to any one circuit.

Therefore, in dwellings, the overcurrent protective device is the sole limiting factor on the total connected load which may be placed on circuits serving the general illumination requirements. You will also note that the provisions of paragraph b. of this section must apply to all other receptacle outlets. In other words, outlets serving unit loads or specific appliances or devices and the outlets on the receptacle appliance circuit must comply with paragraph b. of Section 2116.—G.R.

## Service Switches For Motor Installations

**Q.** As shown in the diagram the installation consists of only two motors. No lighting service or any other service is required. The motor disconnects, etc., are, therefore, service equipment and the type used is approved for service equipment use.



Sections 2351 and 2371 will be complied with since these permit a maximum of six sets of disconnects and six sets of overcurrent devices to serve in lieu of a single disconnect or single set of overcurrent devices, respectively.

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Section 4408, however, would seem to prohibit the use of this construction for more than one motor.—A.J.B.

**A.** Section 4408 seemingly would prohibit the installation as shown above and would require a single disconnect to be installed ahead of the two motor disconnect switches. This section definitely states that the service switch may serve as the disconnecting means for an installation consisting of a single motor.

If the motor disconnects and overcurrent protection devices (branch circuit overcurrent protection which is usually integrated into a common enclosure with the disconnect) are approved for service equipment and have also horsepower ratings, there should not be any difficulty in obtaining approval for the installation as shown in the sketch. It is the writer's opinion that most inspectors would approve up to six sets of disconnects and overcurrent devices provided all motor requirements and service equipment requirements were satisfied as indicated in the sketch and in the discussion.—B.Z.S.

## Service Disconnecting Means and Adequacy

**Q.** The Code recognizes six 15 ampere circuit breakers as a means of service disconnect in a residential occupancy. When we run into one of these old installations and wish to install a separate circuit for an oil burner, we have to rewire the whole service or else violate the Code by adding the extra disconnect which makes seven disconnects. If our customer desires a dryer or automatic washer, considerable money must be spent for a new service before the sale is completed. Who is to blame for such short-sightedness? Why do we have such a Code rule? Who is at fault when the seventh disconnect is added? The Inspector, the Manufacturer, the Dealer or the Contractor?—C.M.

**A.** In reply to your last question the person who installed the seventh disconnect means, violates the N. E. Code, irrespective of the conditions you have outlined. Quite often all of us forget that the provisions of the Code constitute a minimum standard. As a result many of us are completely satisfied when our work meets the Code standard. We have no thought of any new loads which may arise in the future. We are not interested in an adequacy factor which should be considered on all jobs. We are not interested in voltage drop be-

cause the Code has no mandatory provisions for same. We just want a job that passes and as a result, we get just what the N. E. Code tells us in its Introduction; an installation reasonably free from hazard but not necessarily efficient and convenient.

Who is to blame for this short-sightedness you describe? If you can show me the man who ten or fifteen years ago knew that in 1951 we would have the automatic washer, the clothes dryer, the deep freezer, the dishwasher and disposal and the other appliances common to residential occupancies today, I would be inclined to say he is the one responsible for the apparent short-sightedness. And what about 1961, will the same criticism again arise? When will we, all of us, who are interested in the electrical wiring industry learn a lesson concerning adequacy in our electrical planning? The case you have cited certainly proves the justification for all of us to preach adequacy on every occasion possible, not for our immediate profit but for the millions of dollars that must be spent in the future by our customers to avail themselves of the rapid advances in our industry. I believe that all of us concerned with electrical wiring, must coordinate our efforts in obtaining installations which exceed Code requirements with factors of adequacy woven into our service sizes, conductor sizes, circuit loading and so on down the line. We must cooperate in our efforts so that when the Inspector endeavors to obtain adequacy that exceeds Code requirements, someone else does not knock it down with the remark "Don't pay any attention to that bird, he's built that way, he's always trying to build up a job." Let's all get together on this question of adequacy and possibly in 1961, we will not be criticised for overloaded conditions which are so prevalent today. The same holds true for the engineer who lays out a job. The fellow who recognizes the importance of adequacy knows from experience the hazards and pit-falls which lies ahead when it is neglected. Let's all cooperate with his efforts since experience shows that he has been correct many, many times in the past.—B.A.McD.

## Service Switch

**Q.** We are planning the installation of a 200 ampere switch as a service switch for a building and would like to run some 75 feet from this switch with four No. 2/0 conductors with taps taken off along this 75 foot length for four different distribution cabinets. The No. 2/0 conductors

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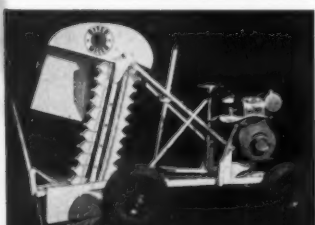
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PERRY, OKLAHOMA

will be run in conduit with a junction box at each point where the taps are taken off for the sub-distribution panels. Now if these taps are smaller in size than the 20 conductors supplying them, need they be fused when no run will be in excess of 22 feet?—F.C.

**A.** It is assumed you are considering the 200 ampere service switch as being limited to 80% of its nameplate rating and are using Type RH feeders from this service switch to the various points of distribution. If this is true, it is possible to carry a tap from this feeder circuit of smaller wire for as much as 25 feet provided the smaller tap conductor has a carrying-capacity equivalent to at least one-third that of the feeder conductor. This provision is found under Section 2434, paragraph d, which reads as follows:

"If the smaller conductors have a current-carrying capacity at least one-third that of the conductor from which they are supplied, and provided the tap is suitably protected from mechanical injury, is not over 25 feet long, and terminates in a single circuit-breaker or set of fuses which will limit the load on the tap to that allowed by Tables 1 and 2, Chapter 10. Beyond this point the conductors may supply any number of circuit breakers or fuses."

Therefore, it would be possible to run taps from this feeder circuit of conductors as small as size 6 for distances up to 25 feet without violating the Code. However, we wish to call your attention to the requirement for a set of breakers or fuses within each distribution cabinet which will limit the entire load supplied by the cabinet to the safe carrying-capacity of the conductors forming the tap between the distribution point and the main feeders.—G.R.

## Grounding On Copper Pipes

**Q.** Article 250, Section 2614 states that connections that depend upon solder shall not be used. Does this apply to grounding to a cold water system of copper pipe with sweated solder joints? We are permitted to ground to the system anywhere on the premises as long as the piping is continuous and unions, if any, are bonded. However there may be, in most all cases are, sweated joints between the attachment and the connection of the copper piping to the street service. Is there a violation of the Code or does the fact that the pipes contain cold water make it permissible to overlook the sweated joints?—L.J.G.

**A.** Insofar as the N. E. Code is concerned there is not, in my opinion, any Code violation. While Section 2614 definitely prohibits the use of solder connection for connecting the grounding conductor to the grounding electrode there is nothing in the Code that says that an electrode consisting of a water piping system cannot have sweated soldered joints. The rule applies only to the connection to the electrode and not to the electrode itself. Irrespective of the foregoing, it appears logical for an Inspector or an electrician to assume that if soldered connections are unsatisfactory at the points of attachment to electrodes, circuits and equipment, they are likewise unsatisfactory in any part of the electrode which forms a path to ground. The only difference I see is the fact that a poor soldered connection is often hard to detect but a poor sweated joint in a water pipe line will leak and must be corrected to obtain efficient operation.

This rule first appeared in the 1940 Code and was the result of difficulties experienced with soldered connections in the ground circuit. At that time I doubt that the question of copper water pipes or the cold water in the pipes was even considered. I do believe however that the question should be recognized by the Code and clarified because there is a difference of opinion among Inspectors on the correct procedure to follow when copper water pipe electrodes are used.—B.A.McD.

## Official N.E.C. Interpretations

### INTERPRETATION NO. 384

(Issued April 25, 1952)

ARTICLE 210—Size of Service Entrance Conductors

**Problem No. 1:** A single family dwelling containing a total area of 700 square feet and a computed load not to exceed 45 amperes, in accordance with Article 210, divided on one 20-ampere and two 15-ampere branch circuits is to be supplied with 115/230 volts, three-wire.

**Question:** What size service entrance conductors of Type SE cable is required?

**Answer:** No. 6 AWG.

**Problem No. 2:** A building having a computed load not to exceed the capacity of three 15-ampere branch circuits, in accordance with Article 210, contains a four-circuit panel approved as service equipment with three 15-ampere branch circuits connected thereto.

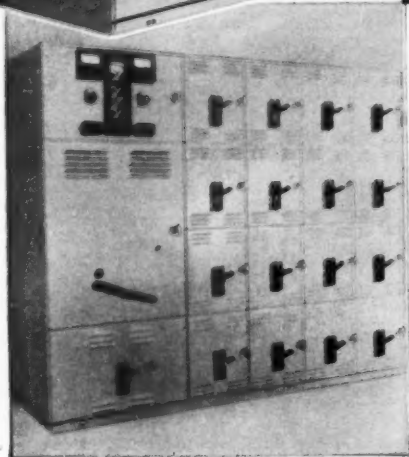
**Question:** May this building be supplied by a service entrance of two No. 6 Type R conductors at 115 volts?

**Answer:** Yes.

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Switchgear...*

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*Specify*



Get all the extras  
Roller-Smith switchgear provides . . .

extras in Safety, Accessibility and Economy of operation.

● **SAFE** All equipment is metal enclosed . . . weather proofed when required . . . built to NEMA and AIEE standards for safe, dependable performance. The "up-to-the-minute" design of Roller-Smith switchgear assures extra safety for operators.

● **ACCESSIBLE** All sections of RS switchgear are easily accessible for quick inspection and adjustment. This cuts maintenance time to a minimum . . . makes it easier to do a thorough job.

● **ECONOMICAL** All Roller-Smith equipment is precision-built according to your specifications . . . tested before you get it. When you specify Roller-Smith, you can count on extra long, trouble-free operation with less "down time" for repairs.

Consult your nearest Roller-Smith representative, or write to us for catalogs which fully illustrate and describe our complete line of low voltage draw-out; moderate duty, vertical lift Metal Clad; and heavy duty Metal Clad switchgear.

**ROLLER-SMITH CORPORATION**  
Bethlehem, Pennsylvania



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Condensed NEMA Motor Standards, included in **ELECTRICAL CATALOGS**, provides a convenient reference for this important standardization data.

McGraw-Hill Electrical Catalogs for Industrial Plants and for Contractors and Wholesalers is exclusively electrical in content.

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**WHICH** make is best suited to your specific job?

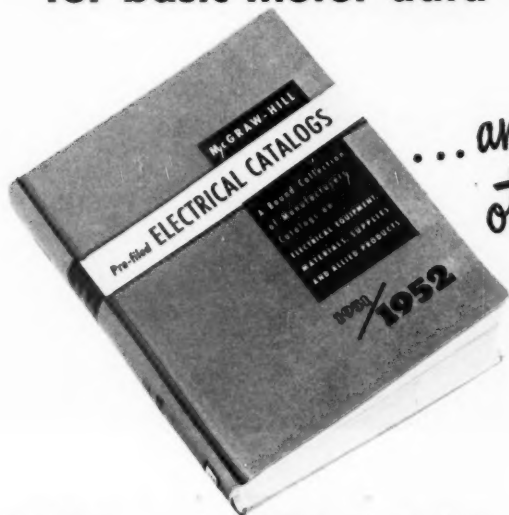
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Capacitor-Start, Fractional Wound-Rotor, Integral



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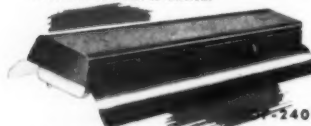
## While the city sleeps . . .

*Leader* LIGHTING  
FOR INDUSTRY



UCOP-2

**NEW Diffuser Unit**—Designed to modify the contrast between lighted work areas and upper dark areas, 7% indirect lighting component. All-steel construction. For 2 or 3 40-watt lamps, in open or closed end models. Porcelain reflector if desired.



UCOP-240

Other Leader industrial units are available in open and closed end styles, for 2 or 3 40-watt, 2 85-watt, for 2, 3 or 4 slimline lamps. Rugged construction, many convenient features, choice of mounting. Write for complete information. No obligation.

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Leader Electric—Western: 800 One Hundredth Avenue, Oakland 3, California  
Campbell-Leader, Ltd.—Brantford, Ontario, Canada

# Modern Lighting

## Drug Store Adopts Luminous Panels

Structural problems were present in abundance when Charmley Drugs modernized their small corner store in Newark, N. J. The floor plan, for example, was irregular with one curved corner, one side broken by a dropped ceiling section and one 30-foot section having a width of only 10 feet. The consultants suggested that a luminous panel ceiling be considered, yet this also raised problems of blocking the overhead sprinkler heads and air conditioning outlets.

The completed lighting installation, therefore, represents a multiple solution involving the shifting of sprinkler and air conditioning facilities to a single side curtain wall, cutting special ceiling panels to fit the various curves in the ceiling plan, suspending and aligning the molded panels, and wiring for ceiling, canopy and display case lighting.

As indicated on the accompanying lighting plan, 65 fixtures were suspended 6 inches below the true ceiling, with the bottom of the lamps approximately 14½ feet above the floor. Fixtures are 3-lamp 40-watt units mounted end-to-end with rows on

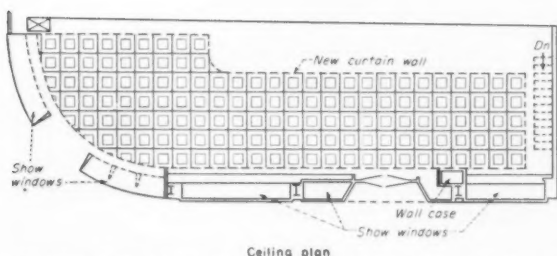
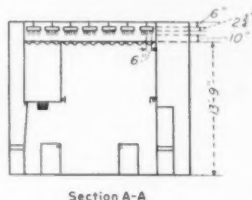
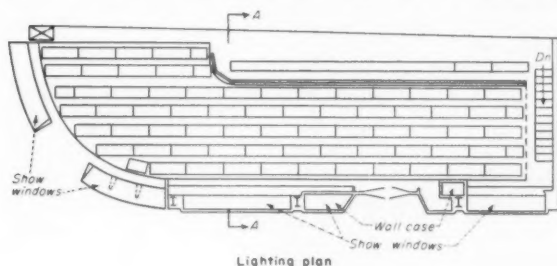
2-foot centers. The panels are translucent plastic supported 10 inches below the lamps.

This general illumination, representing a load of 18 watts per sq. ft. over the main area, delivers between 135- and 145-footcandles to bordering counter tops. It is augmented by

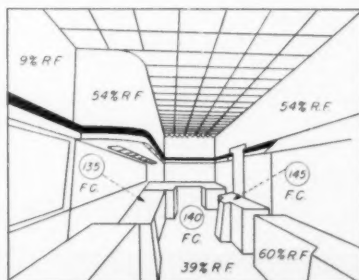
single-lamp border strips above wall cases, by concealed showcase lighting, and by an installation of eight 4-lamp 40-watt fixtures mounted in a continuous row beneath the section of dropped ceiling. The total connected load for lighting is over 15-kw for this 950 sq. ft. corner drug store.



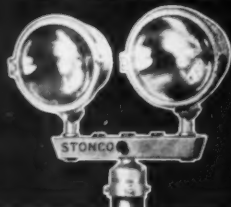
**TRANSLUCENT PLASTIC PANELS** are suspended above the general area of Charmley Drugs, Newark, N. J. Supplemental fluorescent and incandescent units are installed to highlight wall- and show-cases, drug and prescription counters, entrances and exterior windows. Illumination on counters is 145 footcandles.



**LIGHTING PLAN** shows positioning of 3- and 4-lamp, 20- and 40-watt fluorescent units, suspension details of the plastic panels, location of border- and case-lights, and mounting dimensions.



## "SUPERSPOT"



### 100,000 CANDLEPOWER FOR ONLY 300 WATTS

Brilliant illumination for outdoor service. Single spots or clusters—with interchangeable mounting accessories for wall, pipe or ½" conduit. Cast aluminum throughout. UL approved.



### "CUSHION SEAL" LAMP HOLDER

For extra lamp life with any lamp in any weather. Provides maximum lamp cooling and perfect weathersealing of all lamps—long or short—PAR-38 or R-40. Cast aluminum throughout.



### ROLLA-TRAY LIGHT

A "pull-around" utility light with carry-all tool tray for general car shop use — indoor or outdoor. Glazed heat-proof porcelain socket for reflector floods or heat lamps. Cable included.

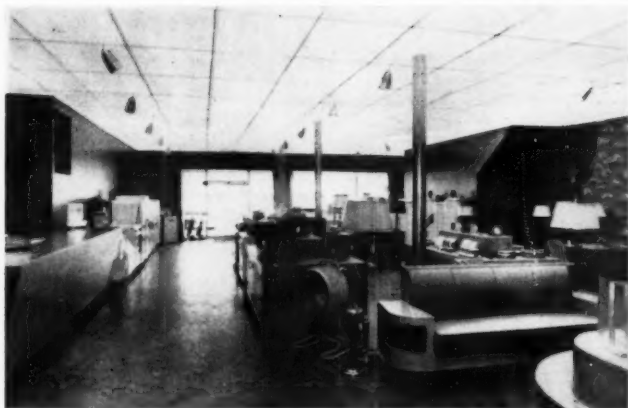


### ISLAND-AREA LIGHT

Porcelain-enamel steel with built-in cast aluminum bonnet for 1 to 5 lamp holders. Exclusive design saves an hour's wiring time per unit. Available in red, blue, cream, white, light and dark green.

• Write today for catalog and illuminating data, Stonco Electric Products Company, 313 Monroe Avenue, Kenilworth, N. J.

# STONCO



**70 FOOTCANDLES** of maintained illumination on counter tops are produced by slimline installation mounted above Benjamin SkyGlo cellular ceiling. Swivelier hoods hold R40 spotlights to provide greater intensities on special displays.

## SkyGlo Ceiling For Utility Service-Sales

Continuous rows of 8-foot T-12 slimline lamps, mounted 23 inches on centers and 23 inches above a Benjamin SkyGlo eggcrate-louvered ceiling, produce a maintained average lighting intensity of 70 footcandles on counter tops in the Chicago Heights Store of the Public Service Company of Northern Illinois. Ceiling panels are suspended 10½ feet above the floor while slimline lamps, operating at 425 milliamperes, are mounted at right angles to the wiring channels. This mounting method resulted in a major materials savings, for instead of allocating an 8-foot chan-

nel for each 8-foot lamp, it was possible to use each channel for several socket connections.

Adjustable Swivelier hoods, stems fastened to the true ceiling and extending down through the cellular panels, contain 150-watt R40 reflector spots to highlight special displays and feature merchandise in this combination sales-and-service office.

Designed by R. C. Geyer and W. S. E. Miller of Public Service, the lighting and wiring installation was the work of the Hensley Electric Company, Chicago Heights electrical contracting firm.



**PERFECT DIFFUSION** of light is obtained from corrugated white translucent luminous ceiling panels in the reception room of the Lone Star Cement Company's offices, New York City. Ten 33½-inch by 41-inch acrylic plastic panels are mounted 12-inches below twenty 30-watt, 36-inch fluorescent lamps spaced on 16-inch centers. Average ft-c level is 55; visual comfort is high.



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## Smithcraft area illumination

NOW . . . advanced design fulfills all the possibilities and benefits promised by overall lighting! Smithcraft Area Illumination is a complete fluorescent lighting system free from all the limitations and mechanical difficulties of previous attempts, yet it is not "custom built" to each installation. Skillfully engineered with unbelievable simplicity, Smithcraft Area Illumination when installed becomes a lighting "fixture" of limitless dimensions, shapes and patterns with unrestricted selection of shielding media and varied intensities within the system. For those who plan, recommend and install, here is an important new tool and business-producer; for the user, Smithcraft Area Illumination opens up exciting new possibilities for effect combined with illumination of unequalled quality.

architects

To the architect, Smithcraft Area Illumination presents a new opportunity for freedom of expression in the integrating of lighting interiors within interior design. Here is freedom of choice with no restrictions as to size, pattern, intensity, shielding, and periphery.

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Engineers can now specify and get any required level of intensity. Or different intensities for different sections of an installation may be recommended to permit optimum usage of store or office areas. Alternating light, rows of lighting, or banks of lighting are possible because of flexibility of switching and a specially designed wiring system.

contractors

Ease and economy of installation are truly amazing! Smithcraft Area Illumination is actually installed in far less time than any combination of ceiling and illumination currently available. No careful dimensioning is required and no special tools, rules, or gadgets. From the time the hangers are in position on the ceiling to the finished installation, only a water level and small screwdriver are required.

owners

For those who own buildings and businesses of many kinds, Smithcraft Area Illumination is a profitable and practical investment. Versatile and adaptable, here is highest quality illumination combined with appearance and effect that sells and produces. Its ease of maintenance and adaptability to future plans and developments are factors that interest any businessman. Yet, its initial cost is comparable to that of a suspended ceiling and troffer system.



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QUINCY, MASSACHUSETTS



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**CITY CHEVROLET LOT** is illuminated by two sources of light mounted on ornamental poles along the sidewalks bordering the display and sales area.

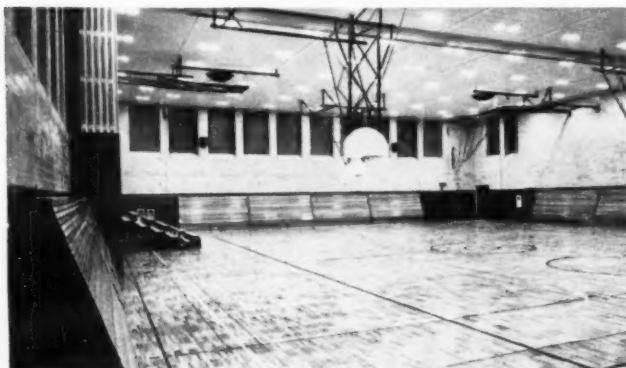


**CLOSEUP** shows positioning of floodlights at pole tops, clusters of PAR38 lamps on the protruding ornamental arms, and cold-cathode signs secured immediately beneath these accent units.

**20 to 85 Footcandles  
For Used Car Lot**

City Chevrolet's used car and truck lot in San Diego, California, believes in throwing plenty of light on the subject of sales promotion. For their general level of illumination is from 20- to 25-footcandles, with accent lighting rising from 35- to 85-fc on the street or customer-viewed side of the displayed cars.

Both general and accent lighting emanates from the same ornamental steel supporting poles, with Smoot-Holman 1500-watt wide-spread floodlight units mounted 24 feet above the ground, and clusters of PAR38 lamps (five per group) mounted on offset hangers at an elevation of 14 feet. Below these arms are circular cold-cathode displays which add a decorative as well as eye-attracting touch to the installation. Mounting poles are spaced on 35-ft centers on sidewalks.



**SHOCK-RESISTING** (no-guard) incandescent Kirlin lighting fixtures, 600-watts per pair, are ceiling recessed in pairs on 9 foot centers, 24 feet above the floor of the Kalamazoo, Mich., South Jr. High School gymnasium. From an initial lighting level of 59 footcandles, the intensity after one year's use has decreased only 6% to an average maintained level of 55 footcandles.



## Diffused Lighting... with **PLEXIGLAS**

You may well think you are under a naturally-lighted skylight when you visit this gallery at the Museum of Fine Arts in Boston. The effect, however, is obtained by the use of translucent white diffusing panels of PLEXIGLAS acrylic plastic, mounted below fluorescent lamps.

PLEXIGLAS luminous ceilings provide high quality lighting in eight new exhibition rooms at the Museum. The totally *diffused* illumination is free of shadows and reflected glare. The effect of daylight, the most desirable condition for human vision, is achieved and the disadvantages of depending upon natural light, with its constantly shifting values, are eliminated.

The even spread of artificial light across the PLEXIGLAS surfaces and the absence of visible lighting fixtures make the luminous ceilings architecturally appealing. Higher light intensity and full color values for the paintings are supplied by directional louvers and recessed spotlights.

PLEXIGLAS luminous ceilings satisfy the requirements of architects and lighting engineers for low brightness ratios, high illumination levels, excellent diffusion, and fixture-free appearance. In addition, the lightweight yet strong diffusers are removed easily and safely for cleaning and for access to the lighting source, resulting in a sustained high level of lighting performance.

If you have a lighting problem, investigate "daylighting" with a PLEXIGLAS luminous ceiling. We will be glad to send you technical details about the installation shown above. Write for them.

Special Galleries, Museum of Fine Arts, Boston, Massachusetts. Architects: Leland and Larsen, Boston. Illuminating engineers: Thompson Engineering Company, Boston. Photograph courtesy of General Electric Company.

CHEMICALS



FOR INDUSTRY

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GAS STATION  
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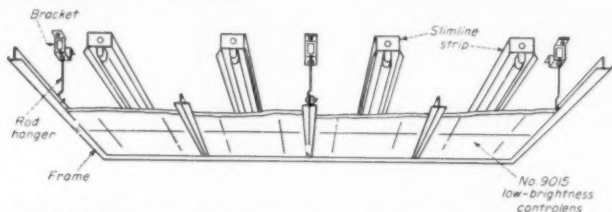


**REVERE ELECTRIC MFG. CO.**

6017 Broadway Chicago 40, Ill.  
LIGHTING EQUIPMENT FOR EVERY NEED.



**LUMINOUS PANELS** above each central bay in this Providence utility show- and sales-room consist of 96 Controlens suspended on inverted T-bar frames beneath 8-foot slimlines. Alternate lamps are wired on separate circuits to provide 2-level illumination intensities.



**CONTROLENS** are supported by framework consisting of inverted T bars. Brackets for rod hangers and Litecontrol single-lamp channels are mounted directly to true ceiling of building.

## Luminous Ceiling Has Two-Level Control

The central section of the Providence (Rhode Island) Gas Company's salesroom measures approximately 21 by 100 feet, divided by structural columns into four 25-foot bays. The ceiling is of white perforated tile with an 82% reflection, column dados and flooring is 49% rf marble, and walls are of 64% rf pastel green plaster.

Over each bay is a luminous panel measuring approximately 8 by 11 feet, composed of 96 Holophane 9015 Controlens arranged in 12 rows of 8 lenses each. Lenses rest on inverted T bars supported by a steel frame which is supported in turn by rod hangers and brackets secured to the building's structural members. The length of the panels make it feasible to incorporate twelve 8-foot T-12 slimline lamps in each installation, with lamps mounted on Litecontrol single strip channels. Wired on alternate circuits, either half or all of the lamps may be used as desired. This provides a 2-level installation, with 76 footcandles delivered to coun-

ter heights when all lamps are in use, and 44 fc when alternate rows only are lighted.

Wattage per bay is 1100, or approximately 2.1 watts per sq. ft. for the central 21-by-100-foot area.

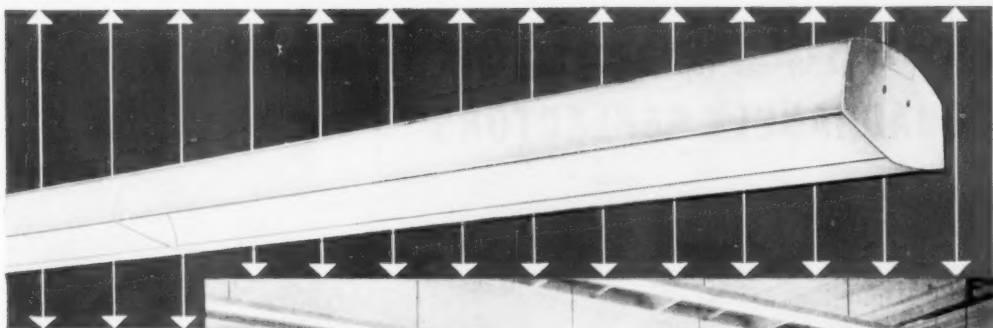
The result is considered excellent for the promotion and sale of home appliances. The clean expanses of light are in harmony with the spacious interior, and the 2-level control provides flexibility to this installation.

## Skyglo Ceiling For Luggage Shop

Three types of illumination are pleasingly combined to light the wide assortment of luggage displayed by Pitts The Trunk Man in San Diego, California.

Providing 50 footcandles of maintained general illumination to the high-ceilinged front-of-store area is a slimline installation, shielded by eggcrate-louvered Benjamin SkyGlo panels supported 20 inches beneath the 200-ma T8 lamps.

To the rear of the store, beneath the



NOTE: ↑  
half the light goes up to  
be reflected from the ceil-  
ing and upper walls.

NOTE: →  
the ceiling and upper  
walls are painted white  
to have a high reflectance  
value.



## SETTING THE PACE IN THE INDUSTRIAL LIGHTING REVOLUTION

### THE WAKEFIELD INDUSTRIAL

# PACEMAKER

*A revolution is taking place in factory lighting—and sparking the revolution is the Wakefield Industrial Fluorescent Pacemaker.*

Study the photo above to see the revolution in action. In the foreground is a new addition to an old plant, lighted by Wakefield Industrial Pacemakers. In the background is a glimpse of the old plant, a gloomy cavern by contrast, lighted in the old way by old style industrial fixtures.

In the new plant area, continuous rows of Wakefield Industrial Pacemakers send half the light up to be reflected from ceiling and upper walls. That's step one in the revolution—a luminaire that has a sub-

stantial upward lighting component. Step two is to paint the ceiling and walls white to give them a high reflectance value. Result: a bright, comfortable, over-all visual environment, markedly free from glare, shadows and sharp brightness contrasts, in which people work better, faster and more accurately and are less tired at the end of the shift.

*The Wakefield Industrial Pacemaker is an economically priced, ruggedly built, heavy gauge steel luminaire that will last a long time, is quickly installed and inexpensively maintained. For more detailed information, you will want our four-page folder. Write to The F. W. Wakefield Brass Company, Vermilion, Ohio.*

## Wakefield Over-ALL Lighting

AT GRAYBAR, GESCO AND LEADING INDEPENDENT WHOLESALERS



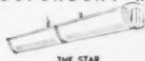
THE GRENADE



THE PACEMAKER



THE COMMODORE



THE STAR

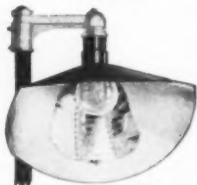


THE WAKEFIELD CEILING

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**QUADRANGLE REFLECTORS"**



ANGLE REFLECTORS  
FOR SIGNS



FLOODLIGHTS FOR  
AREA LIGHTING



POST TOP OR PUMP  
ISLAND REFLECTORS



# QUAD LIGHTING

"I know," says this office girl, "because the orders are routed to me and I see a lot of orders for QUAD."

Here is a line of outdoor lighting reflectors that opens a wide field for profitable sales. The men who install QUAD Reflectors favor them because of ease of wiring. Customers approve them because of correct illumination. Contractors specify them because they find QUAD is good business.

QUAD outdoor lighting units are flexible in design, fully weatherproof and have a porcelain finish that is permanent.

Make QUADRANGLE your headquarters for every outdoor lighting requirement.

## QUADRANGLE MFG. CO.

325 S. PEORIA ST.

CHICAGO 7, ILL.



**EGGCRATE LOUVERED** ceiling shields installation of 200-ma slimline lamps providing 50-ft of maintained illumination to counter tops of Pitts the Trunk Man in San Diego.

mezzanine, is a recessed installation of pre-heat 2-lamp 4-foot fixtures fitted with albalite glass bottom panels, while the mezzanine itself is top lighted by surface-mounted louvered 8-foot slimlines, also operating at 200-ma.

Although the store is comparatively narrow, the wall-to-wall lighting treatment and the use of light paint and woodwork creates an impression of a much larger area. Use of recessed troffers in the rear of the store adds an interesting note of contrast.



**LIGHT CONDITIONED OFFICE** in the sales promotion department at Congoleum-Nairn, Kearny, N. J., combines parchment color wall lineoleum and shielded Silvray fluorescent fixtures. Fixtures use two 96 inch slimline lamps and are equipped with hinged louvers providing 40 degrees of shielding in all directions. Lighting layout, planned in conjunction with new wall and column coverings, was installed using existing wiring system.



# To get efficient fluorescent lighting ... insist on

## This Shield on your ballast



There's more to satisfactory fluorescent lighting than lamps and a reflector. There's always a ballast in the fixture . . . and the way it performs determines whether you'll get *full lamp life, rated light output and satisfactory performance.*

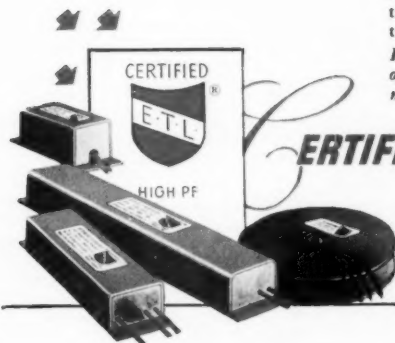
Only CERTIFIED BALLASTS carry the shield that assures best lighting.

That's because CERTIFIED BALLASTS are made to precise specifications, then tested by Electrical Testing Laboratories, Inc., which certifies they conform to these high standards.

There's no excuse for inefficient, unsatisfactory fluorescent lighting when CERTIFIED BALLASTS are available.

Be sure every fixture you get has CERTIFIED BALLASTS . . . the ones with the shield.

● Complete information on the types of CERTIFIED BALLASTS available from each participating manufacturer may be obtained from Electrical Testing Laboratories, Inc., East End Ave. at 79th St., New York, N. Y. Participation in the CERTIFIED BALLAST program is open to any manufacturer who complies with the requirements of CERTIFIED BALLAST MANUFACTURERS.

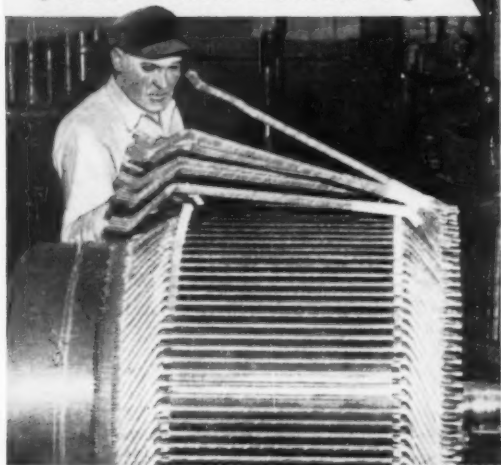


## **CERTIFIED BALLAST MANUFACTURERS**

*Makers of Certified Ballasts for Fluorescent Lighting*

**2116 KEITH BLDG., CLEVELAND 15, OHIO**

**Need coated insulation?**



**...or insulating varnishes?**



## FOR **EVERY** REWIND JOB... there's a quality Irvington Insulation

For motor rewinds that really stand up, look into the comprehensive Irvington line of coated insulations and insulating varnishes.

### OUTSTANDING IRVINGTON PRODUCTS INCLUDE:

**Class "H" Insulations.** Silicone Resin-impregnated Fiberglas\*. Silicone Rubber-coated Fiberglas. Silicone Rubber-coated Fiberglas Tubing. Silicone Resin-coated Asbestos. Silicone Resin-saturated Asbestos. Teflon\*-coated Fiberglas. Silastic\*\*\* Tape.

**Class "B" Insulations.** Varnished Fiberglas. Varnished Asbestos.

**Class "A" Insulations.** Varnished Cambric, paper, nylon, Orlon, silk, rayon. Irv-O-Slot slot insulation.

**Insulating Varnishes**—baking and air drying types. Oilproofing enamels.

**Plastic Tubing, Tapes and Wire Markers.**

\* Owens-Corning Fiberglas Corp. \*\* Du Pont \*\*\* Dow-Corning

Look to

**IRVINGTON**

for Insulation Leadership

INSULATING VARNISHES

VARNISHED CAMBRIC

VARNISHED PAPER

VARNISHED FIBERGLAS

INSULATING TUBING

CLASS "H" INSULATION



Ask for literature on any of these groups of Irvington time-tested products.

Send this convenient coupon now

# Irvington

**VARNISH & INSULATOR COMPANY**

18 Argyle Terrace, Irvington 11, New Jersey

Plants: Irvington, N. J.; El Monte, Calif.; Hamilton, Ontario, Canada

Irvington Varnish & Insulator Company  
18 Argyle Terrace, Irvington 11, New Jersey

Gentlemen:

Please send me technical literature on the following Irvington products .....

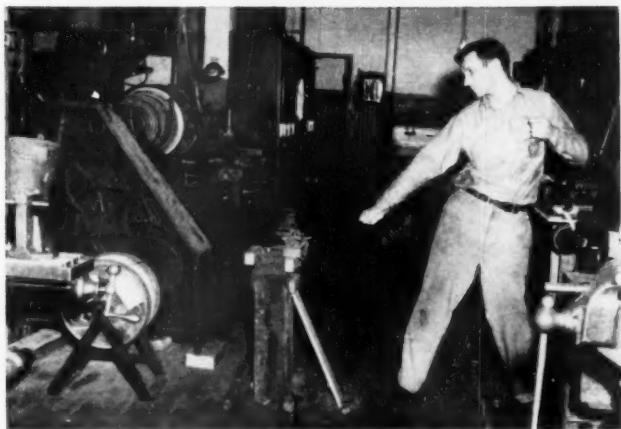
Name.....

Company.....

Address.....

City..... Zone..... State.....

# Motor Shops



**TENSION BLOCK** eliminates the common winding problems of snagging and snapping wire when winding coils. Block provides adjustable tension on wire fed from reel to winding machine.

## Tension Block Solves Winding Problem

An inexpensive, simply constructed device has solved a common winding problem in the Watts and Stern Motor Repair Shop, Philadelphia, Pa. This device, a tension block, has improved the quality of winding jobs and eliminated the difficulties which arise from unwinding wire from a spool for winding coils.

The problem which existed before this tension block was built is an old headache in many shops. When winding field coils, a tension must be held on the wire as it is fed to the coil. The person winding the coil usually maintains this tension with his hand. If this tension is not just right, trouble really develops. If the coils are wound too fast, the wire runs off the spool very fast. Then, if winding slows down, the wire comes flying off the spool, causing snagged and loose coils. As the wire reel then slows, a sudden increase in winding speed will snap the wire. Often, even skilled manipulation of tension by hand cannot prevent these difficulties.

In an attempt to do away with this inefficiency, one of the gang at Watts and Stern came up with the idea of the tension block. A 5-inch by 5-inch block, 24 inches high, was mounted in a vertical position about 4 feet from the front of the winding machine. The block was firmly secured to the floor.

On top of the block, an adjustable clamp arrangement was set up.

Winding procedure, using the tension block, is simple. From the wire reel, mounted on a frame behind the block, the wire is passed through the clamp to the winding machine. To protect the wire, a piece of tubing is used in the clamp and the wire threaded

through it. Pressure is then exerted on the tubing which pinches the wire and maintains the tension when winding. As the requirements of different winding jobs may demand, the amount of tension can be varied with the clamp.

Better and faster winding jobs have resulted from the use of the block. Full attention can be paid to the actual winding, without any mental reservation for the old problem of snagging and snapping.

## Rotor Cradle Speeds Shop Work

A simple wooden rig provides quick and easy movement of heavy armatures in the motor repair shop of Watts and Stern, Philadelphia, Pa. The rig was constructed to solve a serious movement problem which had become a bottleneck to routine shop procedure.

The work load in this shop had reached the point where the overhead hoists and chain blocks were constantly in use. And because this shop specializes in heavy industrial work, almost all of the motors they handled were heavy machines, up to 200 hp., which required some form of mechanical assistance for movement. The problem, therefore, was to provide some means of moving these heavy machines



"BIG OR SMALL, we serve them all", is an expression dramatically illustrated by this pair of transformers being loaded on a trailer prior to delivery to an industrial plant. The units, rated at 1½- and 1000-kva, were repaired simultaneously by the Electric Motor and Repair Company, Raleigh, N. C.

# LATROBE

FLOOR BOXES

WIRING SPECIALTIES

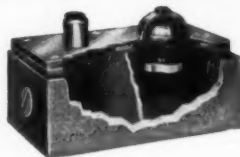
## PRODUCTS

QUALITY THAT LASTS



No. 140 Floor Box  
No. 206 Nozzle

Soundly constructed with 4 1/4" Cover Plate and large Adjusting Ring No. 215. Can be very quickly installed.



No. 252-R Two Gang  
Adjustable Floor Box

Neat and practical with No. 208 Receptacle in one section. One Cover Plate has 1/2" Flush Brass Plug; other has 2".

### ECONOMICAL

### EASY TO INSTALL

"Latrobe" Floor Boxes and Wiring Specialties offer real economy in installation and replacement costs. Their unique design, free of unnecessary parts, means quicker installation and longer service.

Sold Only Thru Wholesalers



No. 471 "Latrobe"  
Pipe or Conduit Hanger

High quality and sure performer yet very economical for hanging pipe or conduit to steel beams. Takes pipe 1/2", 3/4" and 1".



No. 110 "Latrobe"  
Watertight Floor Box

Approved by Underwriters Laboratory. Iron box body. 3 1/2" round brass cover plate. No. 208 fits tapered opening in top of box body.

#### Cable Staples

Millions of these high quality staples are in use all over the country. Packed in cartons, kegs or barrels.



#### "Bull Dog" Insulator Supports

Safe and sure for clamping porcelain or glass insulators to exposed steel frame work. Four sizes.



**ROTOR CRADLE** provides quick and easy movement of heavy rotors in Watts and Stern Motor Repair Shop. This method requires only intermittent use of chain hoists.

when all of the hoist facilities were in use. It was found that a serious work slow-down occurred when machines were left to pile up awaiting a free hoist. A wooden rotor cradle was the obvious answer to the problem.

This cradle consists of two runners for the base and built-up, vertical end pieces with semi-circular slots to accommodate armature shafts. The runners are lengths of 2 by 4's. Bridging these runners, and about three-feet apart, are the foot-high wooden end pieces. The height of these end pieces is sufficient to suspend a cradled rotor clear off the floor.

In use, the rotor is loaded on the cradle, either by hand or quickly by chain block. The cradle can then be pushed around the shop—to the dipping tanks, baking ovens, etc. In many cases, the cradle can first be placed on a dolly which will further speed movement.

Since this rig has been in use, the hoists have been free to handle many additional jobs around the shop. Often, much work can be done on rotors without taking them from the cradle. And the cradle-on-dolly arrangement affords quick parking of machines which are awaiting work. In this way, congested traffic in the shop is easily eliminated.

### Adjustable Reel For Handling Wire

An adjustable, home-made, portable reel gets a lot of work in the motor repair shop of Lovatt Electric Service

EASILY  
INSTALLED

**FULLMAN**  
MANUFACTURING CO.  
LATROBE, PA.

ECO-  
NOMICAL



**"BROAD-JUMPING" FURTHER  
THAN ANYONE BEFORE.  
JESSE OWENS, AMERICAN, SET A  
WORLD'S RECORD IN MAY, 1935,  
WITH A SENSATIONAL LEAP  
OF 26 FEET, 8 1/4 INCHES.**

**JENKINS**

*Gold Seal Tape*  
**GOES FURTHER, TOO...**



**GUARANTEED FOOTAGE**

You get full measure with every roll. Tapes up tight and snug to the last inch.

**NO WASTE**

All Gold Seal Friction Tape tears evenly, does not ravel, molds to uneven surfaces.

**HIGH DIELECTRIC**

Less Gold Seal Tape needed per job. No pinholes; one tape thickness insulates.

**LASTING "TACK"**

Gold Seal sticks to the job under toughest conditions of cold and moisture.

**EASY HANDLING**

Gold Seal does not peel, dry out or smear the hands in hottest weather.

**SPEEDS THE JOB**

Linemen and electricians prefer Gold Seal Tape. It saves time and trouble.

**IT'S YOUR BEST BUY FOR PLANT SUPPLY**

Specify Gold Seal Tape and save.

**FRICTION AND RUBBER TAPES**

In either 10-roll cartons or single rolls. Every roll sealed in cellophane, stays fresh. Jenkins Bros., (Rubber Division), 100 Park Ave., New York 17.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications.

A PRODUCT OF JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JUNE, 1952



# When servicing costs are high as the lights...



## Lower Both Lights And Costs With Thompson Hangers!

**You're losing money when you use two men and a lift truck to service lighting fixtures . . . and you're risking someone's neck! THOMPSON disconnecting and lowering HANGERS facilitate rapid, safe, efficient floor-level maintenance of high-bay lights.**

**You can assure maximum round-the-clock lighting efficiency by following a planned maintenance program. And remember . . . there is no faster, safer or more economical means of servicing overhead lights than with THOMPSON HANGERS. Simple manual operation is exercised at floor level.**

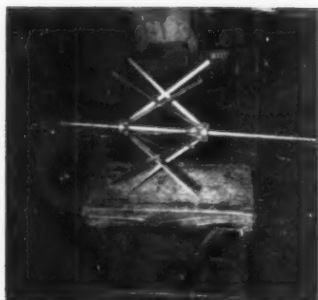
Write today for new illustrated Bulletin TH52 for additional details.



1. DISCONNECT
2. LOWER
3. SERVICE
4. REPOSITION
5. REPEAT

## THE THOMPSON ELECTRIC CO.

1157 POWER AVENUE • CLEVELAND 14, OHIO



**ADJUSTABLE REEL** is an umbrella-like device made from spare parts; is light and portable and easy to use for salvaging motor field coil wire or for reeling loose wire onto a spool.

Company, Hackensack, N. J. This handy reel can be used for unwinding motor field coils when the wire is to be salvaged or for reeling loose wire onto a spool. Construction of this device is a simple and worthwhile project for any motor repair shop.

Just a few spare pieces are required to make up this umbrella-like reel. First, 8 pairs of steel spokes are made up. Each pair consists of two flat spokes, about 15 inches long, about  $\frac{1}{4}$  inch wide and about .050 inches thick, riveted together at their mid-points. Then 8 holes are drilled through the thickness of two bushings. The holes are spaced around the holes in the center of the bushings. Through each of these holes on each bushing, one-inch slotted rivets are pushed. The rivets should have a snug fit in the bushing holes. With the slotted rivets in position, one end of each pair of spokes is riveted to each split rivet on one bushing and, one end of each pair is riveted to each split rivet on the other bushing.

With the spokes secured to the two bushings, a steel rod of the proper diameter is passed through the two bushings. One bushing is then tightened on the rod with metal screws; the other bushing is provided with a take-up screw to allow fixing the position of the bushing anywhere along the rod.

The finished reel is then adjustable for any diameter of spread by moving the one bushing along the rod. The diameter can be set to make large or small diameter coils of reeled wire. In use, one end of the rod is placed in a bearing which is held tightly in a vise.

At the Lovatt shop, many uses are found for this portable reel. The repair gang find it easy and handy to use this umbrella-like wire handling aid. No longer is it considered a chore to reel up loose wire odds-and-ends in any desirable size coils for storing.



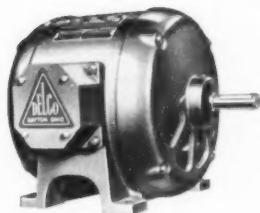
whatever  
the application,  
*you're right with a*  
**DELCO!**

When your product requires the application of power—as a part of the product or to help make the product—you can be sure of complete satisfaction by choosing the Delco motor that's *built* for the job.

Every Delco motor that's made is engineered for the kind of *work* it has to do. It's made of the finest materials, and constructed to *stand up longer* under the roughest conditions.

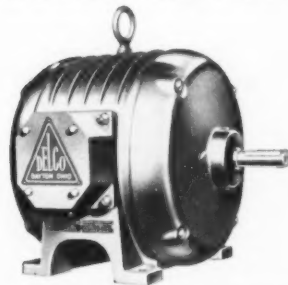
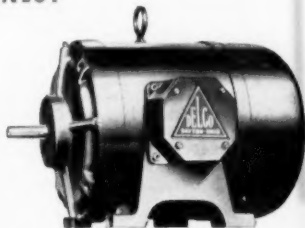
So get the facts on Delco motors *first*. You'll find Delco has the motors you need, and that Delco always meets its commitments. For complete details, write to Delco Products, Dayton, Ohio, or call the nearest sales office listed below.

DELCO FEATURES MAKE DELCO FINEST



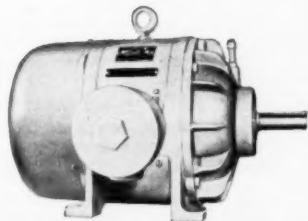
OPEN  
BALL-BEARING  
MOTOR

TOTALLY  
ENCLOSED  
FAN-COOLED  
MOTOR



TOTALLY  
ENCLOSED  
MOTOR

EXPLOSION-  
PROOF  
MOTOR



**DELCO PRODUCTS**

SALES OFFICES: ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DALLAS  
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**DIVISION OF GENERAL MOTORS CORPORATION, DAYTON, OHIO**

*You Can  
Spot*

**FIRE**

**BEFORE IT REALLY GETS STARTED  
with NEW ELECTRONIC DETECTOR!**



**SURE, SAFE  
LOW-COST  
PROTECTION  
24 HOURS DAILY**

You can spot fires without delay with the American Electronic Sentry providing automatic fire detection. The first wisp of smoke across the light beam flashes the alarm . . . warns of fire before the sprinkler heads go into action. This new alarm system virtually ends the danger of destructive fires in warehouses, hospitals, schools and factories.

**AUTOMATIC IN USE . . . EASY TO INSTALL**

The American Electronic Sentry System "watches" an area about 150 ft. x 30 ft. with each pair of Light-Beam Projector and photo-electric Sensor. Additional pairs cover larger areas.

Smoke is "reported" to an Annunciator Panel which may be located nearby, or up to 2 miles away, connected by inexpensive wiring. The signalling device may be horn, bell, siren or light located where most useful. Current consumption is low, about 50 watts a unit.

**NO "ACCIDENTAL" FAILURES**

The Projector has a built-in supervisory circuit to warn of failures. Automatic voltage regulation. Any power interruption sets off alarm.

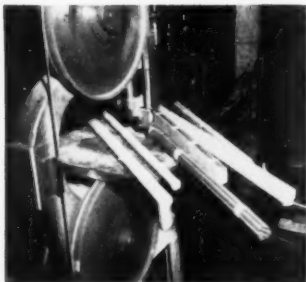
**WRITE FOR FULL DETAILS** Full information on The American Electronic Sentry may be obtained promptly and without obligation by writing to . . .

Approved By  
Factory Mutual  
Laboratories

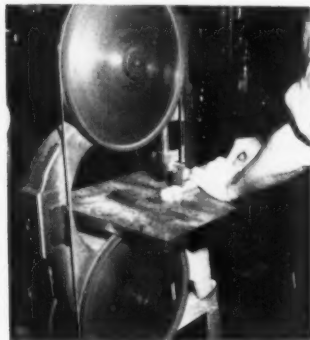
**FM**

**ELECTRONICS DIVISION  
AMERICAN ENCAUSTIC TILING CO., INC.**

901 Kenilworth Ave., Lansdale, Pennsylvania



**SLOT WEDGES** of wood and fiber are bundled with tape into groups of as many as 36 wedge strips. Then a . . .



**BAND SAW** is used to cut a bundle at the desired length. Quickly and easily, a complete set of wedges is cut for a winding job.

**Quick-Cutting Method  
For Slot Wedges**

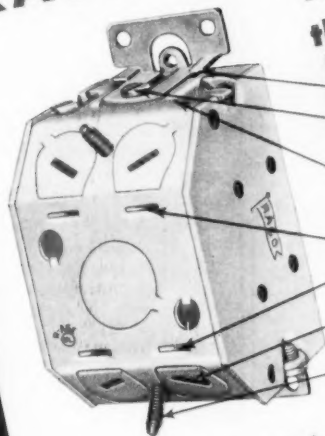
Motor winding jobs get a time-saving improvement with a clever wrinkle on cutting coil slot wedges at the National Electric Motor Repair Company, Passaic, N. J. This method for cutting wedges is one of many shop-tested ideas developed by Andy Anderson, one of the gang at National.

It came to Andy one day that coil winding could be greatly speeded if the coil slot wedges could be cut for size on a wholesale basis, instead of individually. Following up on the idea, he bundled a number of wedge strips with three pieces of tape, marked the desired length and cut the bundle with a band saw. Quickly and easily, he had a complete set of wedges for one winding job.

With this method, any kind of wood or fiber wedges can be cut to size for any motor. And in addition to wholesale cutting, as many as 36 wedges can be cut at one time, this method provides better wedges. The ends of the wedges are cut smoothly with no trace of chipped or broken ends, which often result from cutting wood wedges

# RACO'S BLOS...

the one-screw box  
that's 6 ways better!



- 1 The heavy embossed shoulder on the plaster ear insures greater strength.
- 2 Slot and position of screw allow maximum adjustment — 0" to  $\frac{3}{4}$ ".
- 3 Long, deep embosses on body hold ear rigid and provide a perfect channel.
- 4 Cable rests on these smooth embossments, securely held, well protected.
- 5 Insert screwdriver in these angled slots and one natural twist removes KO.
- 6 Clamp screws emerge from beveled side so box can be mounted on a flat surface.

This RACO one-screw, beveled loom box provides the answer to the electrician's need for a one-screw box that has a plaster ear with the strength to hold permanently, that can be guided evenly into place, and has up to  $\frac{3}{4}$ " of adjustment. What's more, the clamp screw emerges on the beveled side of the BLOS and allows it to be mounted on a flat surface. Here's another example of why RACO leads the field... from coast to coast.

You can always rely on RACO

# RACO

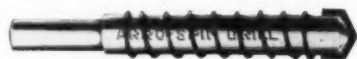
ALL-STEEL EQUIPMENT Inc.—800 Kensington Ave., Aurora, Illinois

"A BOX FOR EVERY NEED"



## ANCHORING and DRILLING DEVICES

WHEN MAKING *Fastenings* TO MASONRY



FLEXO-FLUTE SPIN DRILL



LAG SCREW EXPANSION SHIELD



A-C-E EXPANSION SHIELD



DOUBLE EXPANSION SHIELD



O-E EXPANSION SHIELD



MACHINE SCREW ANCHOR



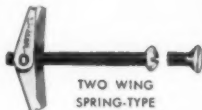
STUD BOLT ANCHOR



LEAD SCREW ANCHOR



MAL-LEAD BOLT ANCHOR



TWO WING  
SPRING-TYPE  
TOGGLE BOLT



SPRING HEAD  
STEEL TOGGLE BOLT



RIVETED HEAD  
TOGGLE BOLT



LITTLE MAJOR TURNBUCKLE



FOUR-POINT HAND STAR DRILL



THREE-POINT DRILL POINT



FOUR-POINT DRILL POINT



TWIST DRILL POINT



RUBBERGRIP  
DRILL POINT HOLDER

**SOLD THROUGH  
DISTRIBUTORS**

**ARRO EXPANSION BOLT CO.**

MARION, OHIO

singly with pliers. Fiber wedges, which ordinarily bend and twist at the end when cut with pliers, are also maintained in good shape in spite of their hollow cross-section.

This wholesale wedge cutting method saves much time at the National shop, and the better cuts on the wedges allow easy insertion of the wedges in the slots.

## Shop-Made Spray And Cleaning Tank

Spray cleaning of motors and motor parts is greatly facilitated by a cleaning tank which was constructed by Tony Curio in the Curio Electric Motor Shop, Allentown, Pa. This tank provides quick and thorough cleaning of all motor parts prior to work, with all the necessary safeguards against the dangers of the cleaning solvent.

The tank was constructed from a minimum of parts and material. The base of the tank is a discarded soda ice-box, the type found in most any confectionery store. Above the open top of this box, a sheet metal enclosure rises to a ventilation duct which leads the dangerous vapors outdoors. A small door in the front of this superstructure affords easy access to the inside of the tank.

Use of the tank is easy and simple. An air hose is used to spray the cleaning solvent on the parts, which are held inside the door of the tank. The same hose can also be used for air-blow cleaning of parts. Armatures and stators which require a thorough



**CLEANING TANK** at the Curio Electric shop was inexpensively constructed from a discarded soft-drinks ice-box, some sheet metal and a minimum of other parts.



# *No unnecessary circuit interruptions...*

## WITH AB-I CIRCUIT BREAKERS

You can't fool the protective trip elements of Westinghouse AB-I Circuit Breakers. Harmless peak, momentary heavy or prolonged light overloads are carried without incident. But, let a short or dangerous overload strike and the tripping element instantly opens all poles.

"De-ion®" Arc Quenchers cut up and quench arcs that follow tripping in less than 1/120 of a second to complete the protective job.

For lasting accuracy, each Bi-metal is calibrated precisely for its rating... tested and sealed to prevent tampering before it leaves our plant. Calibration stays exact for the life of the installation.

With AB-I Circuit Breakers there are no replacement elements to fuss with. After a fault is cleared anyone can "Reset" an AB-I Breaker in seconds with a flip of the handle. AB-I Breakers cannot be held or locked "On" against a fault.

Get the complete facts on AB-I Breaker protection. Call your Westinghouse Representative or write for B-5456, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

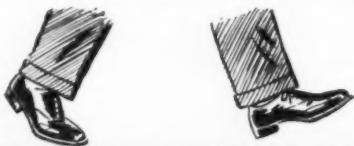
J-30100



YOU CAN BE **SURE**...IF IT'S  
**Westinghouse**

**AB-I Circuit Breakers**  
THE COMPLETE LINE

*"Of course, circuit breakers save money."*



*the first step in every sale*



*is locating a prospect*



*who needs what you have for sale!*

DODGE REPORTS service takes this "first sales step" for most of the leading firms and salesmen in construction. IT CAN FOR YOU.

Dodge field men report when the people who buy or specify want to talk business with you. It is the job of Dodge field men to spend their time combing your market to find out what is coming up—being planned—out for bids—who got the contracts. This timely and vital information is mailed to Dodge users every day.

**DODGE  
REPORTS**  
tell you  
who to sell —  
when to sell

Dodge users save time and money. They need not beat the bushes and chase down rumors about new building. A few minutes each day with Dodge Reports provide more opportunities for doing business than you can get in any other way . . . point out more new prospects coming into the market . . . show up more opportunities for profitable contacts among the people you already know.

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Find out now how Dodge Reports can help you . . . get this new book, the result of 60 years of service to construction men. It tells you how others use Dodge Reports to locate their prospects. The book will be sent without obligation, send for it *now*. Write today to Dept. ECM-6.



## DODGE REPORTS

119 W. 40th St., New York 18, N. Y.

Timely, accurate, comprehensive construction news service  
THE FIRST STEP IN EVERY SALE



soaking can be lowered into the cleaning bath in the bottom of the soda-box tank. When the bath solution is no longer serviceable, it can be run off through a petcock on the bottom of the tank.

This inexpensive cleaning tank has been found completely satisfactory for all the cleaning requirements in the Curio Electric shop. Although the investment was small, Tony Curio is satisfied that this tank does the same job that a much costlier unit could do.



**MOTOR SHOP MEN** Joseph Wagner, Philadelphia; and M. H. Eisenhardt, Camden, N. J., meet again at recent NISA convention in Chicago.



**HIGH FREQUENCY** testing will show equipment defects which normal test methods will not uncover, Samuel Heller, Consolidated Electric Motor Co., New York City, tells NISA members during a technical forum.



**G. E. McINTYRE**, electrical engineer, Dow Corning Corp., Midland, Michigan tells motor shop operators the practical limits on "uprating" motors with Class H glass insulations.

KEEP YOUR PRODUCTION

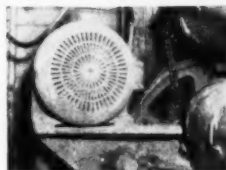
TURNING

IN ANY KIND OF ATMOSPHERIC HAZARD

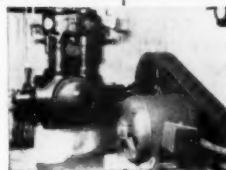
Here are Century splash proof motor's driving fans out in the open, without any protection. You can use the same motors where the plant must be washed down with a hose. Or where there are splashing liquids or falling objects of any kind.



Here is an installation using an explosion proof motor in a tung oil processing plant. You can see how the material clings to the motor and equipment, but it can't affect the vital parts of this Century explosion proof motor.



Here is a motor on a refrigeration compressor in a nice clean room. An open type Century general purpose drip proof motor is therefore used.



CE-732



## CENTURY ELECTRIC COMPANY

1806 PINE STREET • ST. LOUIS 3, MISSOURI • OFFICES AND STOCK POINTS IN PRINCIPAL CITIES

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JUNE, 1952

SELECT THE

*Century*

### MOTOR FRAME PROTECTION TO MEET THE CONDITION

Century Motor users in many different classes of industry are paying more and more attention to electric motor protection. Careful motor selection pays big dividends by keeping production TURNING where atmospheric hazards might affect the vital parts of the motor.

#### You Can Select Century Motors for:

- Normally clean plants.
- Splashing liquids or falling objects. For indoor or outdoor operation.
- For atmospheres containing—oil fog—dust—grit—abrasives—chemicals.
- Explosives.
- Textile lint.

Specify the kind of protection you require on the motorized equipment you purchase. Specify Century motors for the protection that will keep your production turning.

# DRILLS FASTER AND CLEANER, IN TIGHT SPOTS

## Milwaukee 3-speed Right-Angle Drill

Widely used by electrical contractors and plant maintenance electricians, the Milwaukee 3-speed right-angle HOLE-SHOOTER has demonstrated unmatched, time-saving performance. Most powerful 9-lb. electric drill built. Ball and roller-bearing equipped.

Provides suitable speeds for drilling in wood, metal, masonry, concrete, tile. Uses wood bits up to 3" . . . also 1/2" standard steel or carbide-tipped drills.



Used for straight and right-angle drilling . . . bores up to 5" dia. in wood.



Head swivels full 360°. Locks in any position. S-412 Drill with "2-speed Right-Angle Drive" . . . \$74.00

For straight drilling S-412 1/2" HOLE-SHOOTER (above) has a chuck speed of 450 R.P.M. With the 2-speed "Right-Angle Drive" attachment, speeds are 300 R.P.M. or 675 R.P.M.

### Complete S-412 Tri-Speed Kit Contains

- 1 — S-412 1/2" HOLE-SHOOTER, Jacobs geared chuck.
- 2 — "Two-speed "Right-Angle Drive" attachment.
- 3 — 3 special bits — 3/4", 1 1/4", 2 1/4".
- 4 — Special wrench.

\*Pat. Pending

Complete S-412  
KIT. \$88<sup>75</sup>



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5352 W. STATE STREET • MILWAUKEE 8, WIS.

Canadian Distributor: **MATTHEW MOODY & SONS CO.**  
740 Inspector Street, Montreal

## MAINTENANCE TOOLS AND INSTRUMENTS

(FROM PAGE 79)

ampere ammeters, current transformers provide safe and accurate measurements, depending on the degree of accuracy of the C-T and the instrument.

**Voltmeters**—For checking circuit voltages, measuring voltage drops, etc. Their selection again depends upon whether the equipment used is dc or ac or both. It is usually necessary to have a low reading instrument and another with a scale high enough to take care of the highest voltage used.

**Tachometer** — For determining the speed of machines. There are a few types on the market—direct reading instruments and the less expensive hand type revolution counter which is suitable for the mechanic's kit.

**SECONDARY INSTRUMENTS** are used only occasionally, for special maintenance investigations. Included in this category are: (Fig. 4)

**Wattmeter**—Measures electrical power in watts. On unbalanced three-phase circuits, two wattmeters are required. When necessary, the power factor of a circuit can be determined by taking simultaneous readings with a voltmeter, ammeter and wattmeter and determining the ratio between the actual power (watts) and the apparent power (volts x amps).

**Power factor meter**—For direct measurement of power factor.

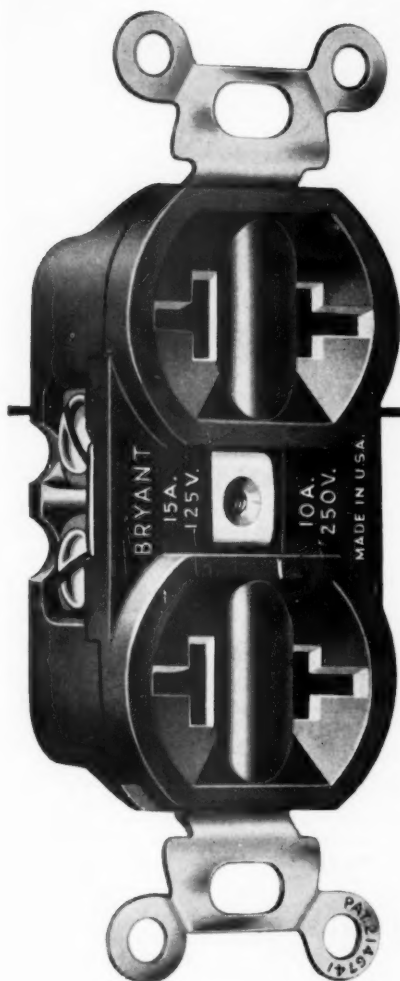
**Combination meters**—Consist of either a few meters in one case or a number of different scales on the same meter.

**Special testers**—A wide variety of such testers are available and are of definite advantage where a constant need for fast field metering exists.

**Recording instruments** — Recording ammeters, voltmeters and wattmeters are available for use where a continuous record of load or voltage fluctuations is needed. In many applications, these instruments are more useful than the indicating types.

**Oscilloscopes**—The cathode ray oscilloscope is an invaluable aid in troubleshooting and analyzing electronic control circuits and devices and in testing such special equipment as mechanical rectifiers.

The number and types of tools and instruments for any maintenance operation depend upon the nature and extent of the work. Any maintenance department must determine the adequacy of its tools and instruments on the basis of its own limitations. To that end, this discussion of maintenance equipment is only a guide.



for  
**easy-to-wire,  
 dependable  
 convenience outlets**

**THE ANSWER IS  
 BRYANT**

The Bryant 9260 back-wired convenience outlet has clamp terminals, a stripping gauge and conductor entrance holes to make for easy wiring and to eliminate exposed wires. The Bryant 9260 can also be wired in the conventional manner. It is totally enclosed, equipped with double-sided contacts and built-in yoke with washer type plaster ears. For high-grade installations in industrial, commercial and residential applications, specify this rugged, back-wired outlet. The 9260 meets all specifications.

**NO. 9260 BROWN**

"T" slots,  
 15 Amperes, 125 Volts.  
 10 Amperes, 250 Volts.  
 (Not shown, No. 9260-I, Ivory)

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 Your Electrical Distributor*



**THE BRYANT ELECTRIC COMPANY**

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**Chicago • Los Angeles**

J-99871





DRIVE-IT split second fastening anchored this electrical and communication ductwork to the concrete subfloor with considerable savings in man hours and dollars to the contractor. Over 8,000 drive-pins were used to hold the system in place while the finish floor was poured.

## *split-second fastening to* **concrete steel**

### EXCLUSIVE DRIVE-IT FEATURES



DRIVE-IT is the only powder-actuated tool approved by Underwriters' Laboratory.



Exclusive Swivel Safety Pad easily rotated for getting into close quarter work.



DRIVE-IT is the only powder-actuated tool which requires but one standard power load regardless of penetration desired.



DRIVE-IT cannot be discharged accidentally due to the push and turn sequence. This, plus the large safety pad makes DRIVE-IT triple safe.



Exclusive Automatic Barrel Extension for fastenings inside junction boxes or other recesses.

Drive-it "300", lowest cost fastening tool.... Low original cost and low operating cost.



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- ☐ Please send FREE catalogue and literature.  
☐ I want a FREE demonstration of DRIVE-IT.

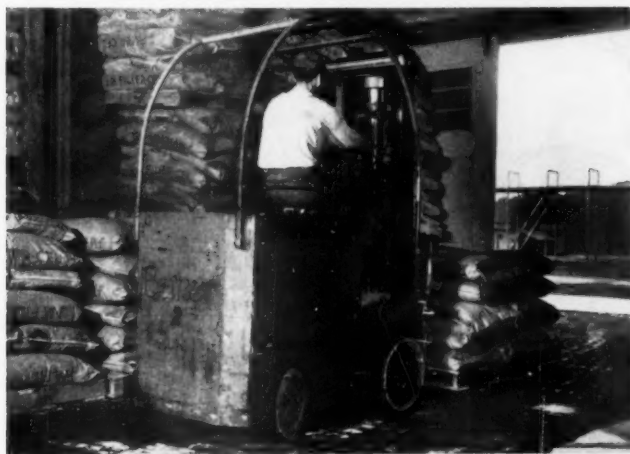
Name

Street

City  State



# Practical Methods



**STEEL FLOOR MATTING** in this supplies warehouse eliminated the materials handling difficulty of using industrial trucks. Previously, trucks would bog down in the unfinished, soft dirt floor.

## Steel Matting Solves Flooring Problem

MATERIALS HANDLING

Unfinished, soft dirt floors are often an obstacle to effective materials handling in many supplies warehouses. Lifting and moving heavy supplies is both difficult and hazard-

ous for personnel in such warehouses where the footing is insecure. And materials handling trucks are easily bogged down in soft dirt. This problem, however, was cleverly eliminated at American Cyanamid's Willow Island, West Virginia, plant.

Recalling how perforated steel strips were used as a matting to make temporary airfields in World

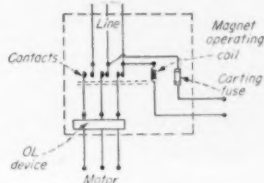
War II, American Cyanamid reasoned that this matting should improve the unfinished floor in one of their storage buildings. The steel matting was installed and proved as effective as it was inexpensive.

Although in this case the flooring was only temporary, until a concrete flooring could be laid, the application would seem to be an inexpensive permanent solution for materials handling difficulties in many supplies warehouses.

## Protecting AC Magnet Coils

MAINTENANCE

Protection for the operating coil in a shunt type magnetic contactor is quickly provided by a cartridge fuse of suitable capacity. This application of cartridge fuse protection has been

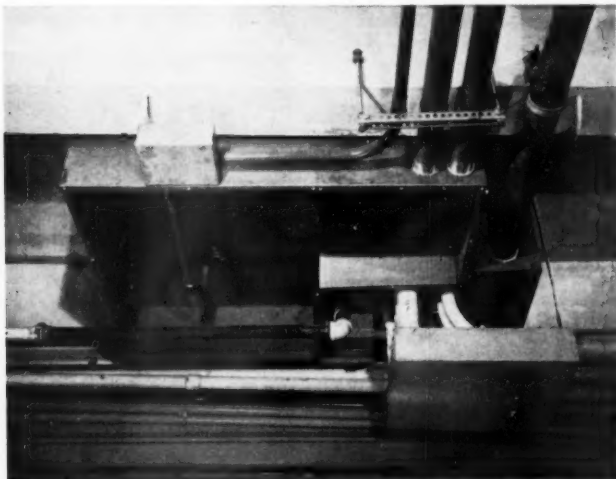


**CARTRIDGE FUSE** inserted in the circuit of the operating coil in this basic circuit of an across-the-line magnetic motor starter protects the coil from burnouts if the armature does not seat properly.

used with much success by Thomas Trail, Catonsville, Md.

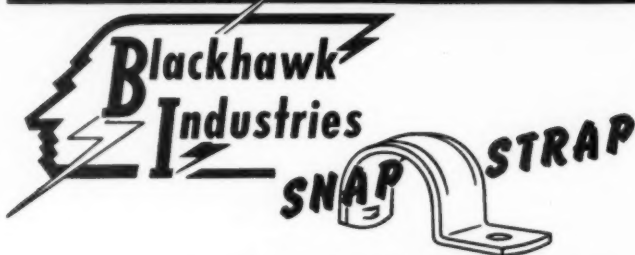
The problem which this application eliminates is a common one. In a shunt type magnetic contactor, the operating coil for the electromagnet is usually connected in parallel with the circuit controlled or with some portion of the circuit. The current through the coil energizes the magnet to close the contacts to the motor or circuit controlled. Often, due to misalignment of parts or a collection of dust or dirt between moving parts, the armature will fail to seat properly on the magnet frame. In such cases, the high resistance or open at the contacts will cause excessive current flow through the shunted operating coil of the magnet. If this condition, which is particularly troublesome in the case of ac coils, is not remedied immediately, the coil will usually burn out.

A sure-fire solution to this problem



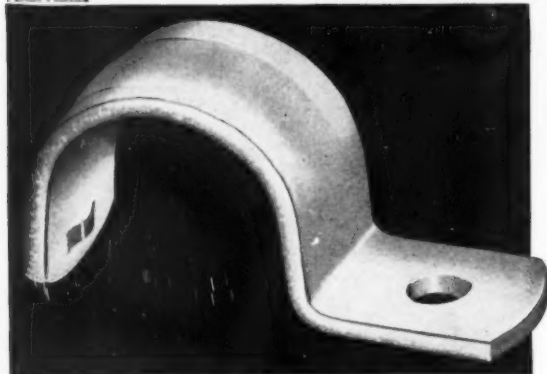
**GROUP OF PULL BOXES** in engine room of Bullock's Los Angeles store typifies the methods of R. R. Jones Electric Company of South Pasadena, Calif., used to overcome structural and piping obstacles when installing feeders and circuits.

**FOR FASTER INSTALLATION**  
Specify and Install



for rigid and thinwall conduit

Patent Pending



Exclusive self-holding feature saves time, eliminates fumbling and dropping, makes difficult installations easier.

- ⑥ Made of heavy gauge steel, zinc plated after fabrication. Wide range of sizes for rigid and thinwall conduit.

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Entrance Cable Fittings • Fluorescent Brackets • Staples  
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Connectors • Wire Holders • Locknuts and Bushings  
Sill Plates • Conduit Entrance Caps

of operating coil burnouts is the insertion of a cartridge type fuse in the circuit to the operating coil. The fuse capacity must, of course, be carefully selected on the basis of the normal current for the coil, and in general on the requirements of the particular application of the magnetic contactor.

## Side-Loading Fork Truck Works In Cramped Aisles

MATERIAL HANDLING

Complete fork truck operation in 6-foot aisles—only half the normal requirement—is now possible with a "Sideload" attachment for industrial trucks, developed by the Automatic Transportation Company of Chicago. The device permits a fork truck parked longitudinally in an aisle to stack to either side without having to turn at right angles to the aisle. Instead of the truck making the 90-degree turn, the forks do it while the truck remains stationary. Thus, the truck can work in half the normal amount of space, reducing the space requirements of aisles and making more useful storage space available for production purposes.

Operation consists of two motions: a rotary action that turns the fork to either side, and a scissors type of expanding motion that pushes the forks forward as much as 54 inches. In use, the truck parks adjacent to the spot where it is to stack its load. Lifting follows standard practice, after which the driver turns the forks to the desired side, then uses the scissors to position the pallet or merchandise.

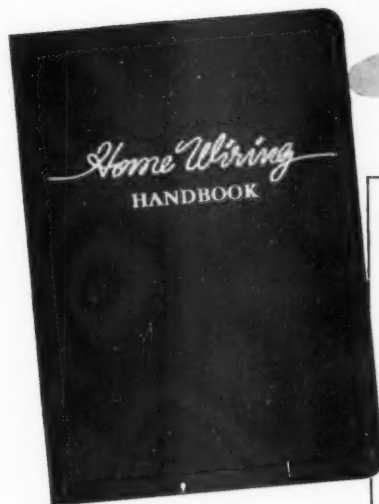
When mounted on a 5000-pound



STACKING TO EITHER SIDE is possible with A.T.C. fork truck that lifts, turns and pushes loads into position. Truck can operate efficiently in 6-foot aisles and can turn 90 degrees to left or right for positioning pallets.

# Revised Edition

## HOME WIRING HANDBOOK



"YOURS FOR  
\$1.00"

### TABLE OF CONTENTS

- Electrical Equipment for the Home
- Four Degrees of Electrical Living
- Electrical Outlets
- Electrical Circuits
- Electrical Control Centers, Feeders and Service Entrance
- Conductors, Voltage Drop, Circuit Protection
- Communication Systems
- Suggested Specification for Single Family Dwellings
- Estimating Electrical Costs
- Building Design and Construction Terms
- Miscellaneous Charts and Tables
- Dimensional and Other Data on Electrical Products

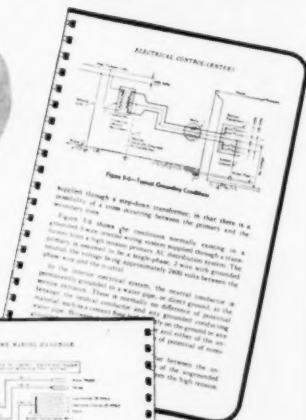
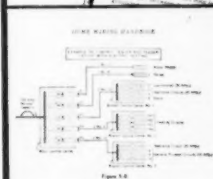


Diagram showing electrical service between high-tension line and load center in home.



Example of control center and feeder layout for a completely electrified home.

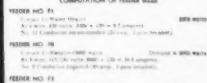


Figure 5-3



Figure 5-4



Figure 5-5

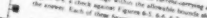


Figure 5-6



Figure 5-7



Figure 5-8



Figure 5-9



Figure 5-10



Figure 5-11



Figure 5-12



Figure 5-13



Figure 5-14



Figure 5-15



Figure 5-16



Figure 5-17



Figure 5-18



Figure 5-19



Figure 5-20



Figure 5-21



Figure 5-22



Figure 5-23



Figure 5-24



Figure 5-25

## Most Popular Book of Its Kind Ever Published

The modern home needs "engineered" wiring. The 3rd Edition (third printing) of the Westinghouse Home Wiring Handbook has 132 pages of technical data and information that equips you with finger-tip data on the planning of home wiring systems.

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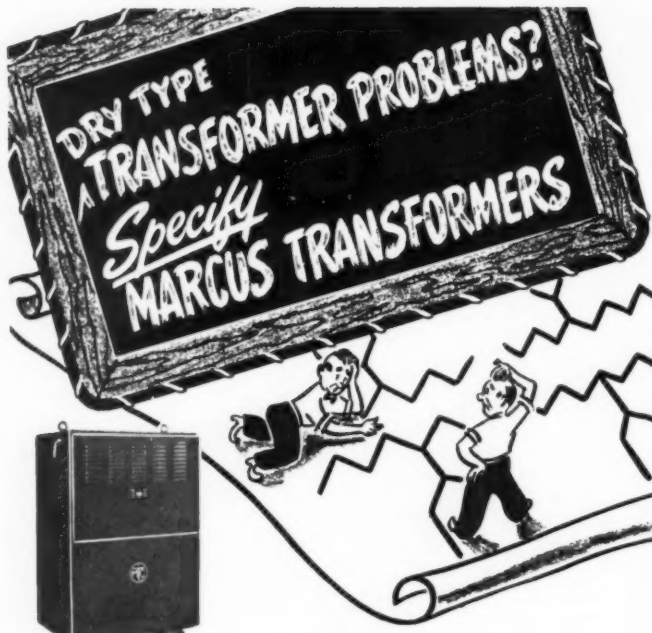
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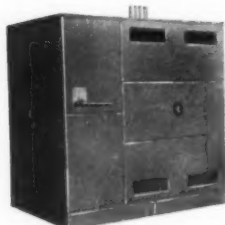
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100 KVA Type F Transformer  
2400/120/240



450 KVA, Type F Unit Substation,  
4160 V. Delta, 60 Cycles, 3 Ø—  
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15,000 Volts to meet  
Individual Requirements

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MARCUS TRANSFORMERS  
CONFORM TO THE STANDARDS  
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Made by a pioneer in the dry type, air-cooled transformer field. Eliminate need for liquid filled units. No hazardous, inflammable oil or toxic liquid to fuss with. Maintenance of oil level, foreign matter, sludge accumulation, and subsequent filtering are relegated to the "horse and buggy days".

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**ARE SAFE** — No explosion or fire hazards. No fire proof vaults. Class B and C heat proof insulations.

**ARE ECONOMICAL** — Lower cost installation and operation, negligible maintenance.

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PIONEERS IN THE FIELD OF AIR-COOLED TRANSFORMERS

capacity Skylift truck, the Sideloader can handle a pallet load weighing up to 2500 pounds, measuring up to 4-by-4-feet. Other truck capacities are in the same general proportions. The entire arrangement is operated by the truck's hydraulic system; it is governed with conveniently-located push-buttons, and a system of electrical interlocks protects against accidentally extending the load forward before the trucks are turned to the side. This feature prevents the load from exceeding the inch-pound torque capacity of the loader.

#### Thymotrol Drives Promote Greater Production

CONTROL

The use of a Thymotrol drive on a winding reel at the Lee Paper Company in Vicksburg, Michigan, has stepped up paper production by 25%, according to Lee Chief Engineer R. L. Husset. In addition to increasing the output from a former 8 to a present 10 rolls per day, the paper rolls are neater, more compact and more uniform.

The solution is found in the maintenance of constant tension on the paper; formerly attempted manually but now done automatically and electronically by General Electric equipment and controls.

Since paper speed is constant as it comes from the coating machine, and since the roll on which it is wound becomes larger during the paper-winding operation, the speed of the roll must be reduced gradually by just



**WINDING REEL** in Lee Paper plant is regulated by G. E. Thymotrol drive which automatically maintains constant tension on paper coming from coating machine. Production has been raised 25%. Electronic tubes are now in their third year of constant 8-hours-per-day service.





"I wonder what happened to me!" said Alice

**ALICE** in Wonderland ate the magic cake and grew until she was more than nine feet tall. Our National bureaucracy also seems to have partaken of the magic cake of power. Bureaus in our government have grown in number and scope until their activities now control, to a great extent, the lives of all individual Americans. Department after department adds more and more people--state, justice, commerce, treasury--not to mention those sprawling emergency born agencies of price control, N.P.A. and other alphabetical subdivisions.

The number of employees of our federal, state and local governments continues to grow. During many recent months, personnel was added

to the federal payroll at the rate of 1,500 daily.

What is the reason for this mushrooming? The Korean War? Threat of war in Europe, Southeast Asia, or the Middle East? Obviously not! A glance at the federal budget gives the answer. The estimated cost of all governmental functions for the fiscal year 1952 is in excess of 70 billions of dollars, an increase of 26 billions, or approximately 60% more than last year.

When will it end? Only you, the individual citizen, who carries the bureaucratic load on his back, can stop it. It will end when enough patriotic men and women demand from congress that the Washington Wonderland start shrinking back to reasonable proportions.



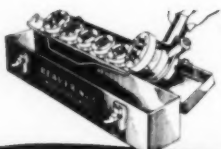
## The Youngstown Sheet and Tube Company

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The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.



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with enclosed ratchet  
— for safety

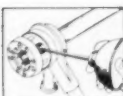
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THREADS BOLTS 1/4 TO 1 INCH

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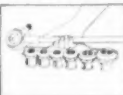
Enclosed ratchet for safety.



Square shaped dies, no weak section.



Bolt dies available.



Handy carrier furnished free.

the right amount so that tension will not increase to the breakage point or drop to the wrinkling stage.

Now in its third year, the winding machine is operating 8 hours a day, with the original Thymotrol electronic tubes still in service.

## Black-Light Inspects Varnish Coating

PRODUCTION

An inspection technique which utilizes ultra-violet black-light has solved a very serious problem for the American Microphone Company, Pasadena. The black-light is used in conjunction with a fluorescent additive to the varnish coating applied to transmitter elements for military telephone hand sets.

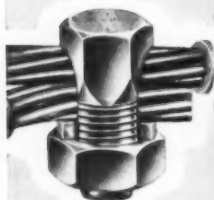
The problem was one which has continually plagued manufacturers of military equipment for use in the tropics. Such equipment must be thoroughly tropicalized by coating with a transparent fungicidal varnish. This coating must be applied to each element of the equipment to protect the elements against the severe extremes of tropical weather. The importance of this coating, however, necessitated careful inspection. And under ordinary light, it was impossible to detect gaps in the varnish coating.

Working in conjunction with Ultra-Violet Products, Inc., South Pasadena, Calif., American Microphone finally developed a technique which eliminated any chance of incomplete tropicalization. A fluorescent material was added to the fungicidal varnish, and black-light ultra-violet lamps were installed at the varnish coating and inspection tables. When the tropicalized transmitter element is inspected under the black-light, the fluorescent material in the varnish glows brilliantly, making any gaps in the varnish application immediately visible.



**BLACK-LIGHT INSPECTION** of military telephone transmitter elements reveals any gaps in the tropicalized coating of fungicidal varnish with a fluorescent additive.

## For Dependable, High-Pressure Connections



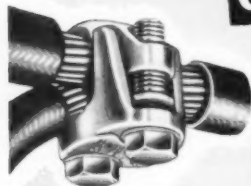
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**New! Non-twist locking device**—prevents rotation of stem when relamping.

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**90% EFFICIENT**—new silvered-bowl lamp automatically restores unit to initial efficiency. Floor-level relamping with pole-type changer simplifies maintenance.

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— new low prices.

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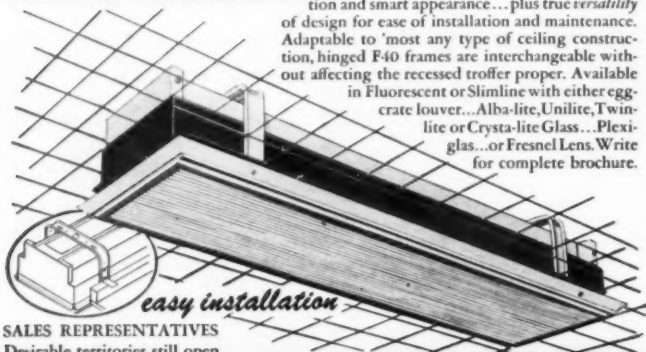
All concentric-ring fixtures for use with silvered-bowl lamps are covered by U.S. Pat. #2,303,747 owned by Silvray Lighting, Inc.

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## Inert-Arc Torch Speeds Turbine Fabrication

—PRODUCTION

An internally water-cooled inert-arc welding torch has accelerated fabrication of power-recovery turbines for aircraft engines at the McGregor Manufacturing Corp., Birmingham, Alabama. In addition, the use of this torch has greatly reduced production costs on this defense-vital operation.

The advantages of this inert-arc torch over the previous equipment have been closely observed by the McGregor engineers. Downtime for adjustment of the tungsten electrodes was reduced, and the nozzle design of the torch effected more efficient gas consumption. The reduction in gas consumption, at least 25% over the former process, afforded a further reduction in cost by curtailing the amount of tungsten required. An efficient internal water cooling system also reduced tungsten consumption and provided a more stable arc.

In the work on power-recovery turbines, an Inconel part is welded to a cast stainless steel base. This welding operation is shielded from behind by sealing up the ends of the power recovery turbine and maintaining helium pressure at 22 psi through a tap.

McGregor utilizes this same welding technique on another mass production operation—the welding of piston-rod guides to piston-rod cross-heads. In this operation, the inert-arc torch is used with 1/8th inch diameter No. 347 stainless steel welding rod as the filler metal on the parent metal of No. 347 stainless steel.

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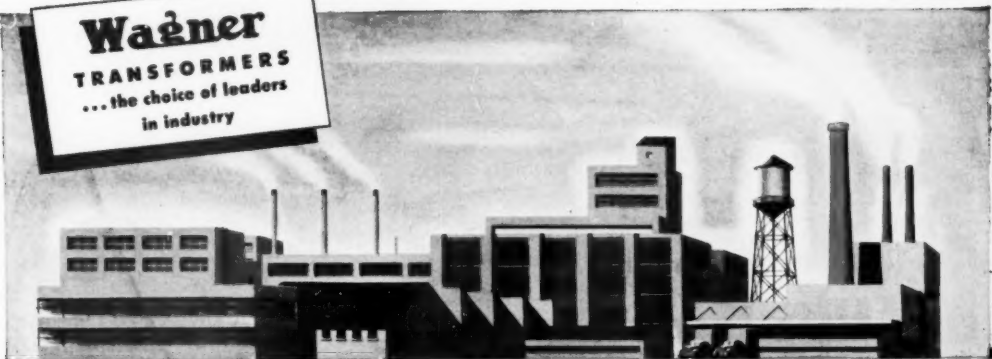
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famous for performance  
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**COPPER TUBE AND PRODUCTS, INC.**

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**TRANSFORMERS**  
... the choice of leaders  
in industry



## **Wagner Dry-Type Transformers** *...safe, efficient power distribution for your plant*

Wagner Dry-Type Transformers are the answer to the problem of bringing the right voltage to load centers economically—yet with complete safety and dependability.

They can be used for a variety of purposes, such as insulating a lighting circuit from a power circuit, obtaining a 240/120 volt 3-wire circuit from a 2-wire system, operating low-voltage portable lamps, and supplying machine tool lighting from the power circuit. They are frequently used to step down power distributed at 480 or 600-volts to supply lights, portable tools and other 120-volt devices.

Wagner Dry-Type Transformers are economical—they eliminate long runs of secondary copper... they provide steady voltage with minimum line losses... they are light in weight and compact—inexpensive to install and easy to move if changes in plant facilities make it desirable.

They are safe to use—without fireproof vaults or other special protection—even where fire hazards are present.

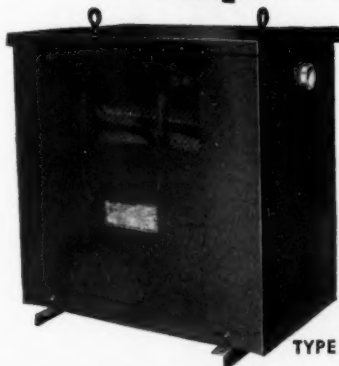
\* \* \*

Wagner general-purpose dry-type transformers are available in single-phase, two coil units (Type AE) in sizes 1.0 to 200 kva, 600 volts and below; and in three-phase, two coil units (Type AP) in sizes 3.0 to 300 kva, 600 volts and below. Type AA Auto-transformers are also available. Write for a copy of Bulletin TU-90. It gives many suggestions that you can use.

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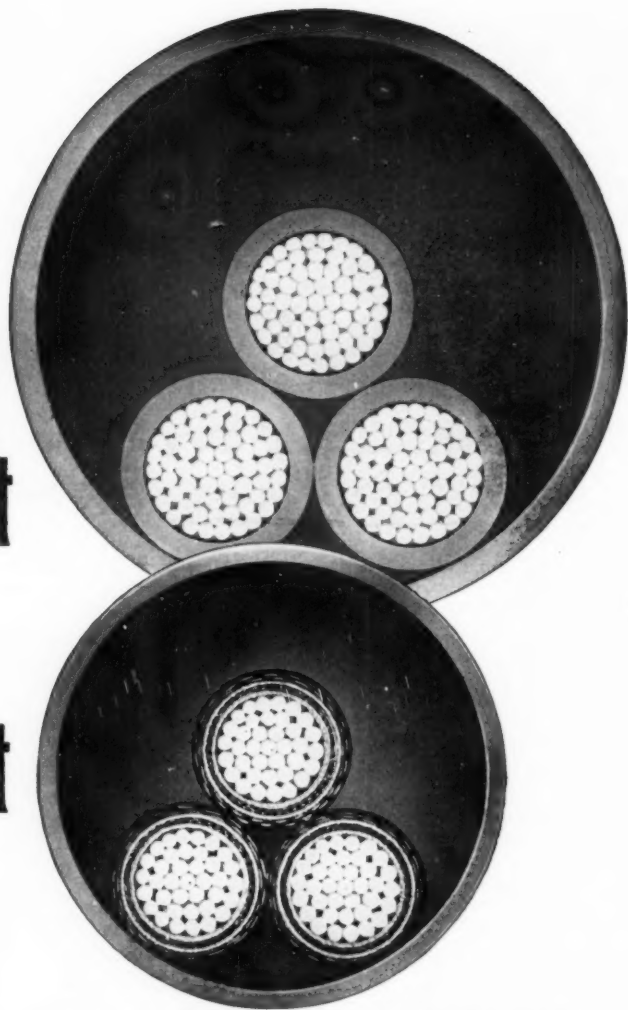
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\*Comparison made with Type RH based on Chapter X, National Electrical Code, 40°C-104°F Ambient

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# In The News

## NEMA's 4th I. L. E. Held in Cleveland

The 4th International Lighting Exposition and Conferences was held in Cleveland May 6-9, in the huge Cleveland Auditorium. Nearly 6500 lighting engineers, architects, electrical engineers, electrical contractors, electrical utility lighting men, plant engineers and others registered for this four-day lighting event.

Sponsored by the Commercial and Industrial Lighting Equipment Section of the National Electrical Manufacturers Association, this Exposition was easily the outstanding lighting show of 1952. It was a veritable store of new lighting ideas, lighting designs and equipment. Those who attended had an opportunity to see lighting progress in the making, to learn of lighting design and lighting application trends, and to see and examine first hand many new and noteworthy developments.

This exposition is the fourth affair of its type to be sponsored by NEMA since World War II. Attendance was somewhat of a disappointment to the sponsors and exhibitors, being about 25% below that of the last Exposition held at the end of March, 1949, three years ago, in Chicago. Those who attended agreed, however, that what the 4th ILE lacked in attendance was more than offset by the quality of the exhibits and the outstanding display of Merit Award entries from the 1952 NEMA Merit Award Competition.



**CANADIAN VISITOR** to the Cleveland Lighting Exposition was D. Roland Webb, consulting electrical engineer of St. John, New Brunswick, who reviewed the exhibits and signed up for literature with Jack Parks, Holophane Co. Inc. representative of Detroit, Michigan.

Lighting exhibits were displayed in 128 booths by 84 manufacturers of lighting equipment, lamps, and lighting components, trade publications and trade and technical associations. Exhibits embraced lighting equipments and components of practically all types which form the "tools" of the art and science of lighting. In addition to the standard popular lighting designs which have proven so popular over the past three or four years, many manufacturers also showed new luminaire designs, lamps and components, and new types of lighting equipment not previously shown or announced. These new developments are now in the process of being announced and publicized by the various manufacturers, and will soon be finding their way into new installations across the country.

It is impossible to list and review all of these new lighting developments here in the limited space available for this report. Instead, the trends in general terms are outlined. Several manufacturers displayed luminous ceilings of one type or another, some using glass, some plastics, some continuing the use of louver sections. One manufacturer displayed a series of shallow molded plastic luminous elements in various forms which can be grouped in a wide range of modular and special design patterns. Another displayed a basic luminous ceiling structure which will accommodate a variety of glass, plastic or louver panels. Grid ceilings acoustical baffles were on display, and many manufacturers exhibited murals, photos and color transparencies show-

ing various luminous elements in jobs already installed.

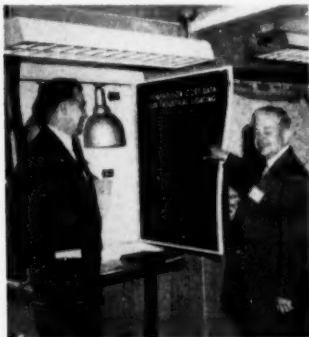
Another trend of great importance noted in several booths was that of industrial reflector luminaires having an upward component of light to softly illuminate the ceilings of industrial plants—providing a better visual environment and better quality lighting for factory workers. One manufacturer exhibited an explosion-proof fluorescent luminaire with excellent maintenance features, and practically all manufacturers stressed new features to simplify the problem of easy installation and easy maintenance. Two out-



**WINNER** of three Gold Seal Merit Awards in the 1952 NEMA Merit Award Competition was George E. Pieper, Metals & Controls Corporation engineer, Attleboro, Mass., who is being congratulated by Carl W. Zersen, managing director of the Chicago Lighting Institute, who was Chairman of the Board of Judges of the Merit Award Competition.



**ENAMEL FINISHES** for reflectors were explained by John K. McGuire (left), Glidden Co., Cleveland, to Carl Weisel and Wade Slusser, both of Monarch Rubber Co., Hartsville, Ohio, as they toured the exhibits at the 4th International Lighting Exposition in Cleveland May 6-9th.



**INDUSTRIAL LIGHTING** comparative cost data, shown in chart form, interested Bruce E. Gilman, electrical engineer with Standard Oil Co. of Indiana, Whiting, Indiana. R. D. Williams, Chicago manager of Pittsburgh Reflector Co., explains the chart to Gilman.

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**CUBAN VISITOR** to the 4th International Lighting Exposition was Ricardo E. Franklin, electrical engineer and contractor with the Hall de La Construcción Co., Havana (right), who was pleasantly surprised at the tremendous progress in lighting design and application exhibited at the show. B. D. Levaure, vice-president of Pittsburgh Reflector Co., and Chairman of the NEMA Lighting Equipment Section sponsoring the Exposition, pointed out highlights of this progress to Sr. Franklin.

standing developments in disconnecting devices were also on display.

Noteworthy lamp developments on display included a new "rapid start" 40-watt fluorescent lamp that does not require a starter, and uses a ballast which is smaller, lighter, cheaper and quieter, and color-corrected mercury vapor 400-watt lamps, both standard and with built-in reflectors (R-type bulbs).

Incandescent lamp fixtures continue in popularity, and many new developments in this field were also shown—recessed lens units, bowl-silvered lamp luminaires, recessed and adjustable spot units for R-lamps, and many others.

One important trend was the use of improved commercial luminaire designs for fluorescent lamps. Nearly all designs shown were for use with both slimline and "pre-heat start" lamps, and better shielding and lower brightness were noted for all designs. More ingenuity in light control principles for fluorescent luminaires was evident, based on producing better lighting results and a better quality of lighting. Many designs incorporate parabolic reflectors for light and brightness control, and nearly all commercial units present a low brightness, luminous appearance without dark areas to produce an annoying shadowed area when installed.

One manufacturer announced and displayed a luminous indirect luminaire for schools and other commercial applications, in which a one-piece special plastic reflector is supplied for 8-foot slimline lamps, for individual unit or continuous row application. Another manufacturer featured troffer units, claiming the most complete line

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**when you plan for the best  
in recessed lighting,  
specify uni-flow**

## **uni-flow** fluorescent troffers

Here is a picture preview of the MITCHELL UNI-FLOW Fluorescent Troffer . . . completely new . . . dramatically different and superior . . . years ahead of anything in the recessed lighting field. What you are looking at is the result of two full years of development work that has paid off in a product so advanced and improved that the architects, contractors, utility men and wholesalers who have had an opportunity to examine it, say unanimously: "This is it!"

If you are now planning a recessed lighting installation, you owe it to your customers, your clients and yourself to learn the full facts about MITCHELL UNI-FLOW. Write, phone or wire today for the most important news in recessed fluorescent lighting.

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**EASY INSTALLATION** features of a new troffer on exhibit at the 4th International Lighting Show in Cleveland attracted the attention of electrical contractor A. E. Taras of Cleveland (right). His questions were answered by Jay Rosenthal, New York City salesman for Ruby-Philite, Inc., Long Island City, N. Y., who displayed the troffer.

of troffers being produced today, with 2442 possible combinations.

As in previous Expositions, the spotlight was focused on the winning entries in the 1952 NEMA Merit Award Competition. These were displayed in art gallery style at the entrance of the Exposition Hall. Numbering over 200, they represented the best techniques and latest interpretations of Planned Lighting as conceived and put into practical installations by electrical contractors, wholesalers, consulting engineers and architects, electric utility light and power men, and owners and users of industrial and commercial lighting.

Gold Seal Merit Awards were made for 23 entries. These were as follows: electrical contractors—4; utility lighting and power men—6; electrical wholesalers—5; architects and engineers—4; and owners and users—4. Many of these entries were made jointly by lighting men in different classifications.

Merit Awards with Distinction were made on 27 entries, of which five went to electrical contractors, and 14 to architects and engineers. Merit Awards were made to 196 other entries.

Gold Seal Awards and Merit Awards with Distinction were made to all winning contestants as part of the Conference program. Gerry T. Morrow, Chairman of the Merit Award Competition Committee, chairmanned the presentation ceremony, and the Awards were made by the panel of judges under the chairmanship of Carl W. Zersen,

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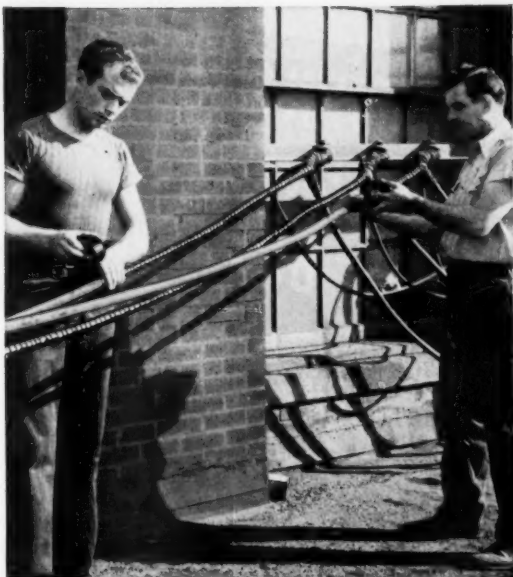


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See those two men wrapping worn cable insulation with "Scotch" Electrical Tape No. 22? They're saving \$5,000 in new cables plus \$10,000 in factory shut-down time at a large manufacturing company in New England. Here's why this remarkable tape is so ideal for the job...



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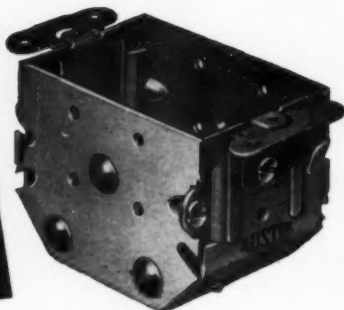


**FOR GENERAL PURPOSE USE** where extra heavy-duty outdoor weather protection is not required, try "Scotch" No. 33 Electrical Tape. It's available in many widths and lengths including the popular "Job Size" rolls— $\frac{1}{4}$  in. x 20 ft. packed 12 to a screw-top container.



The term "Scotch" and the plaid design are registered trademarks for the more than 200 pressure-sensitive adhesive tapes made in U.S.A. by Minnesota Mining & Mfg. Co., St. Paul 6, Minn.—also makers of "Scotch" Sound Recording Tape, "Undermat" Rubberized Coating, "Scotch-lite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 270 Park Avenue, New York 17, N. Y. In Canada: London, Ont., Can.

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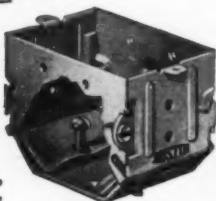
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3 nubs facing outward on each side of box prevent box from tilting. First nub is  $\frac{7}{8}$ " from front of box to permit adjustment for wallboard or plaster.



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On any application . . . controlling yard or remote building lights . . . operating motors, stokers, burners or other industrial equipment . . . the time switches you use must be reliable. That's why it's smart to use Paragon's built-in accuracy and reliability.

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Illustration shows Model 301 straight "ON and OFF" Time Switch for use where two or four operations per day are required. Self-starting, heavy-duty motor, available in 115 or 230 volt, SPST, SPDT and DPST models.

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**INDUSTRIAL REFLECTORS** of new open-top construction were of interest to G. P. Siddall (left), Development Engineer, and R. J. Schroyer (right), Electrical Engineer, both of Goodyear Tire and Rubber Co., Akron, as they toured the 4th International Lighting Show exhibits at Cleveland. D. D. Westberg (center), of Benjamin Electric & Mfg. Co., Des Plaines, Ill., explained construction and operation of the new reflector design.

Managing Director, Chicago Lighting Institute, who was chairman of the Board of Judges.

Mr. Zersen first gave an analysis of the Merit Award entries, pointing out their significance and indicated trends. Then after the Awards had been made, Gold Seal Award installations were projected on a large screen while Mr. Zersen reviewed the lighting layout and lighting details for each.

The Conference program headlined such top officials in government, lighting and allied fields as Jos. S. Schuchert, Manager, Commercial Sales Department, Duquesne Light Co., Pittsburgh; Luther D. Shank, Deputy Director, Electrical Equipment Division, N.P.A., Washington, D.C.; S. L. Drum, Vice-President, New Orleans Public Service, Inc.; and Chairman of the Better Light Better-Sight Bureau; Dr. Sylvester Guth, Research Scientist, General Electric Co., Cleveland; George P. Wakefield, Product Development Engineer, F. W. Wakefield Brass Co.; and Miss May Callas, Interior Decorator.

The Conference program opened officially on Tuesday, May 6 at Noon when B. D. Levaux, Chairman of the Industrial and Commercial Lighting Equipment Section of NEMA formally opened the Exposition by introducing Thomas A. Burke, Mayor, Cleveland, and several other honored guests. Mayor Burke welcomed the Exposition group and visitors to Cleveland, and was acknowledged by S. R. Naysmith, General Chairman of the Exposition Operating Committee, after which the distinguished guests and committee members made an official tour of the exhibits.

The first Conference session was comprised of a talk on "Mobilizing

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Eliminates time waste of telephone operator and other employees in "man-finding."

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**"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION**



**ROUND TABLE** discussion on lighting was broadcast by Station WGAR, Cleveland, during IES Great Lakes Regional Conference, May 5th. Participants were IES officials E. M. Strong, Cornell University, Ithaca, N. Y.,—Senior Vice President; Walter Sturrock, General Electric Co., Nela Park, Cleveland,—Past President (1950-51); and Samuel G. Hibben, Westinghouse Lamp Division, Bloomfield, N. J. —President.

With Planned Lighting," given by Joseph S. Schuchert, Manager, Commercial Sales Department, Duquesne Light Co., Pittsburgh, and the presentation of the Merit Awards. Mr. Schuchert discussed the history of Planned Lighting and showed how it is being used to advance the nation's welfare. He made a plea for the continuance of the Planned Lighting program, and stressed again the need for "planning" every lighting installation in order to insure the customers who buy lighting the best installations possible.

On Wednesday evening over 1000 lighting industry men attended the Exhibitors' Dinner, honoring the NEMA Board of Governors, and listened to a talk on the subject, "Mobilize to Advance America's Welfare," which was presented by Hon. Dewey Short, Congressman from Missouri.

The second conference session was devoted to "Mobilization Through Lighting," and consisted of two timely talks. One was on "Building Under Present Controls," by Luther D. Shank, Deputy Director, Electrical Equipment Division, NPA, Washington, D. C., and the other was on "Customer Education—Basis for Successful Planned Lighting Sales," by S. L. Drumm, Vice-President, New Orleans Public Service, Inc., and Chairman, Better Light—Better Sight Bureau.

Mr. Shank outlined CMP controls as they relate to construction, and as differentiated from production controls. He reviewed the materials and metals supply situation, and showed how it affects construction, which in turn affects the total annual volume of the lighting industry. Construction requiring lighting equipment was about \$10.7-billion in 1947, Mr. Shank said, and estimated that similar construction demands in 1954 will reach

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## Light, Easy to Handle

Orangeburg 4" Standard weighs only 2 lbs. per foot—and Nocrete with its heavier walls weighs only 3.6 lbs. per foot. Workmen can carry several lengths at a time. No other type of conduit lays so fast—and at so low a cost.



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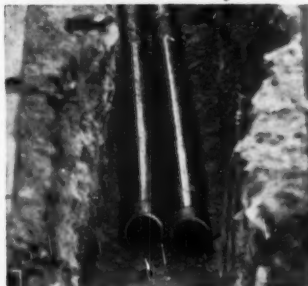
The long, light weight lengths speed the work. There are practically no losses from breakage because the material is tough, resilient — not brittle. Properly handled there is no chipping or cracking—a good profit point.

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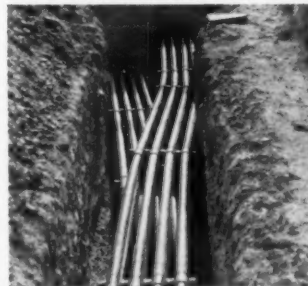


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↑ ORANGEBURG NOCRETE installed without concrete encasement. Its extra heavy wall makes NOCRETE practical for many single or double duct runs.

## Standard with Concrete Encasement



↑ ORANGEBURG STANDARD installed with concrete encasement. The preferred conduit for banks of three or more ducts.

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Orangeburg Fibre Conduit has a low coefficient of friction. The smooth abrasion-free bore reduces the danger of cutting or marring of cable sheath when pulled in.



## Easily Toolled on Job



Workmen use an inexpensive lathe to tool Taper Sleeve Joints on short ends after being cut by any ordinary saw to needed lengths. All this saves time and saves money for the contractor.

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## Taper Sleeve Joints For Better Profits

Tapers machined on the ends of Orangeburg Conduit right in the field are as accurate as those machined at the factory. Only a few light blows on a block placed against the coupling are needed to drive it firmly against the shoulder of the conduit. No cement nor compound is needed. The joint is water-tight, filtration proof.



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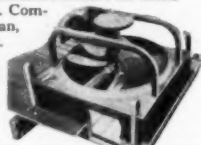
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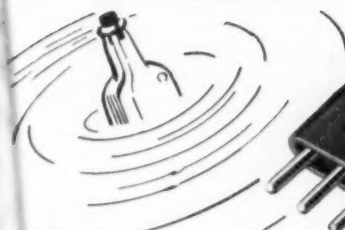
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M.E. 152.1

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JUNE, 1952

\$23.7-billion, or an increase of 115% in seven years. Lighting equipment shipments in 1947 were reported at \$251-million, and in 1948 at \$264-million. In 1949, construction remained at about the same rate as in 1948, but lighting equipment shipments dropped to \$230-million, Mr. Shank reported. In 1950, lighting shipments rose to \$276-million, and rose again in 1951 to \$311-million, while construction requiring lighting remained at about \$22-billion for both years.

Mr. Shank predicted that 1952 construction requiring lighting will approximate \$23.7-billion, and lighting equipment at \$331-million, still higher than the 1951 rate, or any rate since 1947. He forecast 1953 lighting volume shipments at \$340-million, and 1954 volume at \$341-million, and stated that these estimates are conservative.

Summing up, Mr. Shank said "The growth of the lighting industry is due primarily to the creative art and ability of its members. Probably more than any other industry, it can build its own future. It not only serves the needs and desires of its own markets, it creates needs and desires where none existed before."

Mr. Drumm asked why the lighting industry, with a wealth of marvelous products to promote, hasn't made more progress with the job of re-lighting American factories, schools, homes, stores and offices according to modern standards, and then answered his own question. He summed it up in one brief statement "Our customers will buy and use the amount and type of lighting they need only when they have been shown why they need it—when they understand fully the benefits it will mean to them—and realize that these benefits are worth the cost of the installation required."

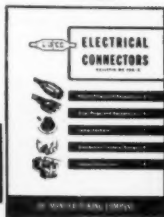
The Better Light—Better Sight Bureau is working in two fields, Mr. Drumm stated. One is the education of present customers—children now attending school, who will be the customers of the future. It is an advertising and promotion type of program, the other a teaching project.

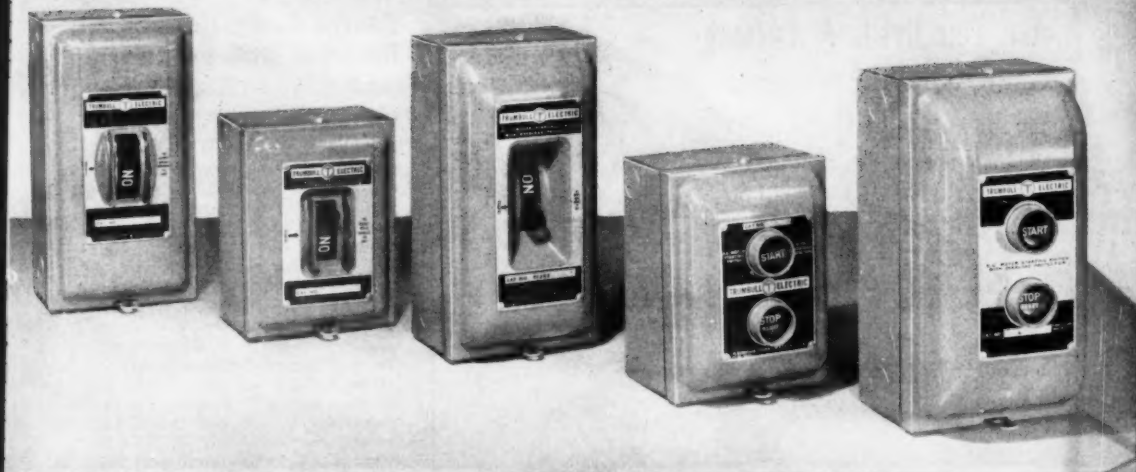
The third conference program was devoted to "Future Horizons of Visual Comfort Evaluation and Their Effect on Human Performance," and was presided over by Dr. Ward Harrison, consulting engineer of Cleveland. Sylvester K. Guth, Research Scientist of General Electric Co., Nela Park, Cleveland, gave a summary of methods of comfort evaluation (for seeing), and George P. Wakefield, product development engineer with the F. W. Wakefield Brass Co., Vermilion, Ohio, discussed the effect of environmental engineering on luminaire design.

Male Plug  
No. 340M

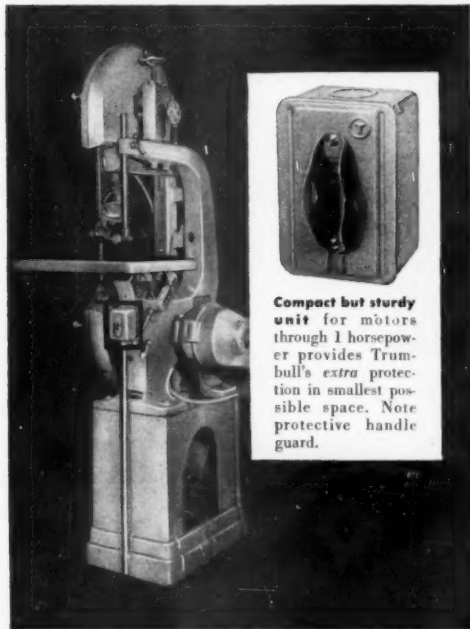
Female Plug  
No. 340F

FREE





Trumbull Manual Motor Starters are designed to control and protect motors up to 7½ horsepower. Note the clean attractive appearance of this representative group of pushbutton and toggle types. Third from left is special loom switch for textile applications.



Typical installation of a Trumbull Manual Starter in a machine shop. Unit is positioned for maximum operating convenience.

## When you recommend motor protection be sure it includes this extra protection

You wouldn't recommend manual starters that didn't provide some motor protection. But why recommend mere overload protection when there is this extra protection in Trumbull Manual Starters whether it's a pushbutton or toggle type:

- **EXTRA PROTECTION against accidental starting**—No chance of an accidental bump starting or stopping the motor because every toggle or pushbutton is guarded.
- **EXTRA PROTECTION against misreading**—Exceptionally clear, unmistakable ON and OFF markings.
- **EXTRA PROTECTION against tampering**—Doors can be locked and handles (on toggle types) can be locked. Unauthorized personnel cannot tamper with starter or operate (toggle) motors.
- **EXTRA PROTECTION against fault-finding delays**—Clear trip indication facilitates immediate location of faults.
- **EXTRA PROTECTION against outside conditions**—An enclosure for every application: general-purpose, water-tight and dust-tight, hazardous-location, as well as a special loom switch for textile plants.
- **EXTRA PROTECTION against temperature changes**—The heater, vital overload watchman, is fully enclosed in a special thermal cavity.
- **EXTRA PROTECTION against installation mistakes**—Heater is so designed that it *can't* be installed incorrectly.

By sticking to Trumbull Manual Starters—whether requirements call for a compact fractional horsepower unit or one of the trim-looking pushbutton or toggle units for motors up to 7½ horsepower, the user is assured of *fast action* on overload or stalled-rotor conditions with Trumbull's improved overload device, *positive, quick-action tripping* without kick-outs from vibration, and *easy resetting* with contacts that *can't* be closed against overload.

Write today for circulars TEC 7 and 317A on Trumbull Manual Starters.

# TRUMBULL ELECTRIC

DEPARTMENT OF GENERAL ELECTRIC COMPANY  
PLAINVILLE, CONN.

Are You Drilling, Cutting  
and Chipping—Concrete  
and Masonry the Hard Way?

(30 Blows Per Minute)

Just try a

**SYNTRON**

**ELECTRIC HAMMER**

Only One Working Part—The Piston

(3600  
Blows  
Per Min.)



... see how fast and easy  
it can be done—and save  
money and time.

Write for Free Catalog Folder



**SYNTRON CO.**

690 Lexington Ave.

Homer City, Pa.

Eliminate all Cluster Light Headaches

with Austin's new  
**"FLOATING SOCKET"  
LAMPHOLDER!**



Patent Applied for

Cat. No. CLD-150 for 150-watt lamps.

Cat. No. CLD-35 for 300 and 500-watt mogul base lamps.

Aluminum alloy. Completely wired. Heatproof, weather-proof gasket. Removable retaining ring for easy socket replacement.

**Snug Fit Under All Conditions!**



LONG LAMP



SHORT LAMP



ECCENTRIC LAMP

Accommodates Physical  
Variations in Lamp—  
Assures Positive Contact—  
Eliminates Breakage

Floating socket moves forward or side to side in an eccentric plane to compensate for variations in size and shape of lamps, sockets and castings. Insures tight seal and positive electrical contact.

**THE M. B. AUSTIN COMPANY**  
NORTHBROOK, ILLINOIS

## George F. Hessler Receives McGraw Award

The Electrical Distributors Medal and Purse under the James H. McGraw Award, was conferred upon George Hessler, vice president of Graybar Electric Co., New York, on Wednesday, June 11, during the annual convention of the National Association of Electrical Distributors in Atlantic City.

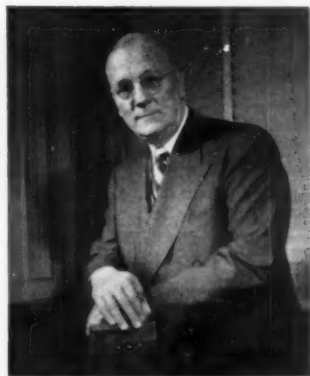
Mr. Hessler received the Award for distinguished achievement in coordinating the essential functions and services of the electrical distribution industry with the needs of government during the current national emergency.

The Medalist was recommended to the Committee of Awards by the following panel of Judges: E. B. Ingraham, Times Appliance Co.; F. R. Fiseman, Sr., Revere Electric Supply Co.; Herbert Metz, Graybar Electric Co.; and John F. Myers, Westinghouse Electric Supply Corp.

The citation accompanying the award read as follows:

"George F. Hessler, Vice President of Graybar Electric Company, Inc., during the past eventful decade has devoted his persuasive talents and statesmanship to guiding the broad relations between his industry and government agencies during periods of national peril. His efforts and counsel were directed toward active support of the principles and purposes of essential controls during periods of crisis. His broad knowledge and objective thinking persuaded recognition and understanding of the vital functions of electrical distribution resulting in the more effective use of the distributive industries in the national effort.

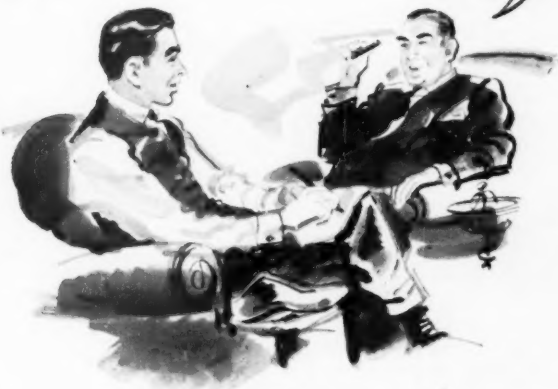
"At the outbreak of the Korean action, the electrical distributor was relatively better recognized as an essential supplier due largely to his untiring efforts in the earlier conflict. When emergency legislation heralded further difficulties, it be-



GEORGE F. HESSLER

"I'm sold on  
Edwards and  
their way  
of doing  
business"

"Their equip-  
ment's tops, too.  
You don't need a  
trapeze artist  
to install it!"



Fact! Today more and more contractors and distributors prefer Edwards. And for excellent reasons. They like:

**Edwards Dependability:** For over 80 years Edwards has pioneered in the design and development of precision-built Electrical Signaling, Communication and Protection equipment for Schools, Hospitals, Industry, Offices and Homes.

**Edwards Cooperation:** All Edwards equipment is designed with the contractor in mind . . . to install easily, economically . . . save him maintenance, man-hours, overhead . . . deliver a bigger profit on every job.

**Edwards Protection:** All Edwards business goes through the distributor who services the contractor in the sale of Edwards staples. The distributor also profits from the system business developed by Edwards. *Double reward!*

**Edwards National Advertising:** Month after month Edwards advertising in leading national magazines reaches important prospects in major markets . . . builds business and profits for distributors and contractors not only for systems but Edwards staples as well.

*It pays to work with Edwards.*

**EDWARDS®**  
World's Most Reliable Time, Communication and Protection  
Products For Schools, Hospitals, Industry and Homes.

### Time is Money to Contractors



Edwards equipment is designed to save the contractor valuable man hours . . . give him a bigger profit on every job. Here are a few examples:

- The new Edwards Fire Alarm Station can be mounted without balancing or juggling . . . wires connect to terminals from the front.
- The mounting plates of the Adaptel and Adaptorn can be fastened to any standard backbox.
- Edwards Easi-Mount Transformer can be installed through knockouts in standard backboxes by tightening the screw on the outside of the box.
- Program Instrument Backboxes can be mounted before plastering.
- Edwards Audio-Visual Hospital Equipment fits standard gang face plates and backboxes. Telephone jacks, outlet receptacles also can be mounted and ganged together.

These are a few of the many Edwards advantages that spell maximum ease of installation, rugged, trouble-free operation with minimum servicing and maintenance. Time means money to contractors. Save it with Edwards.

For further information, write  
Dept. E-6, Edwards Company, Inc.,  
Norwalk, Conn.

## YOUR SPECIFIC NEED



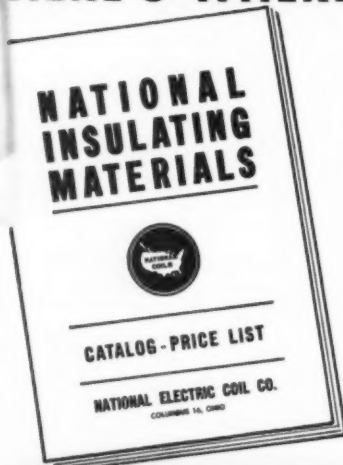
ASKAREL filled 750 KVA (three-phase) load center transformer for indoor or outdoor use

## is the job of *Standard* TRADE MARK TRANSFORMER REPRESENTATIVES

● Your Standard representative stands ready to assume your most difficult transformer problems, and he is backed up by a competent Engineering Department that knows exactly how to accomplish the job you want done. Standard, with more than 30 years of experience, can meet your specific requirements without any alterations. Write us today for the name of your nearby representative. He can save you both time and money!

THE STANDARD TRANSFORMER COMPANY  
WARREN, OHIO • OFFICES IN PRINCIPAL CITIES

## Need Insulation? HERE'S WHERE TO FIND IT



If you use electrical insulation — a little or a lot — this pocket-size catalog-price list can be as handy as your right arm. It's free; write for it today. No searching through page after page for the item you want. Every item is carefully grouped with others of the same basic characteristics. Specifications and cost of every size or weight of every item are given. Every page is marked so clearly that you can't turn to it without knowing at a glance what's on it. First-page index lists every item, both alphabetically and by catalog number. It's really a time-saver. And when you order from it, you get quick action — you get good insulation. We can quickly supply special shapes and non-standard items, too.

## NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U.S.A.

ELECTRICAL ENGINEERS MAKERS OF ELECTRICAL COILS AND INSULATION—  
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

came apparent that the National Association of Electrical Distributors could be the instrument for the most thorough consideration of impending industry problems and their equitable solution. His proposals for the industry's cooperation with the government, and his suggestions for preparing the industry for its role in the new emergency, were the foundations upon which the Association's subsequent activities were organized.

"Electrical distribution was among the first of the industries to have an Industry Advisory Committee appointed by N.P.A. Here again his efforts were exerted toward hastening the appointment of two committees for electrical apparatus and supplies, and for electrical appliances, to the mutual benefit of the government and the industry. His active service on the apparatus and supplies committee has been carried out with great distinction.

"When the Office of Price Stabilization issued its basic pricing order the distributor was placed at a serious financial disadvantage. Supplementary regulations eventually provided the relief necessary to permit the distributor to function effectively and provide the services necessary to the emergency. Mr. Hessler's work, and practically his work alone, accounted for the survival of the distributor in this crisis.

"His wise counsel and tireless work have contributed materially to the great growth of the electrical distributing industry, to the National Association of Electrical Distributors, and to the advancement of the industry as a whole."

## NISA News

Chicago Convention became history. The attendance came from all over the country, Florida to New England, New Orleans, Texas and the Pacific Coast. It was particularly nice to see 20 from the Ontario Chapter, for



**DISCUSSING** electrical industry progress are (L to R) E.M.E. secretary Joseph Spielmann, Wisconsin Electric Power Co.; Milwaukee contractor A. R. Schmidt, who has been in the electrical business since 1884; and E.M.E. Show chairman Erwin Soller, chief electrician, Phoenix Hosiery Co., Milwaukee.





*Important  
Announcement  
to the  
Lighting Industry*

*Electro  
Manufacturing Corp.  
and  
Bright Light  
Reflector Company  
(SILV-A-KING)*

**...are now**

**combined into**

# Electro Silv-A-King

C O R P O R A T I O N



More than half a century of lighting experience and the facilities of two well-known organizations have now been combined into one of the industry's most important and comprehensive sources for all lighting equipment.

Through this consolidation, ELECTRO SILV-A-KING INC. is now in a position to insure more efficient, more rapid and more economical service from two main points of production and distribution.

Regardless of your location, an experienced

lighting engineer from the combined, nationwide sales staff is readily available for consultation and assistance on every problem.

From this one, dependable source, you can now select lighting equipment for all commercial and industrial installations—indoors and outdoors. The extensive ELECTRO SILV-A-KING line of incandescent and fluorescent fixtures is manufactured to meet the industry's most rigid requirements . . . guaranteed to assure complete satisfaction in every detail.

Offices in all Principal Cities

► **Electro Silv-A-King CORPORATION**

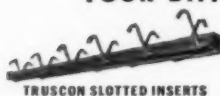
**FACTORIES: 2000 WEST FULTON STREET • CHICAGO 12, ILLINOIS  
FAIRFIELD AND STATE • BRIDGEPORT 5, CONN.**

## TRUSCON PRESSED STEEL INSERTS

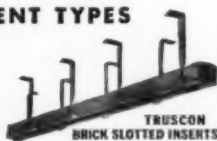
...the electrical contractor's answer to the problem of:

- anchoring** . . . . motors, blowers, transformers, etc. to ceilings, walls and columns.
- fastening** . . . . electric cables to ceilings and walls or in tunnels and subways.
- suspending** . . . lighting fixtures from ceilings, walls or columns.
- carrying** . . . . auxiliary framing which supports the various cables, wires and other instruments in telephone systems.

### FOUR DIFFERENT TYPES



TRUSCON SLOTTED INSERTS



TRUSCON THICK SLOTTED INSERTS



TRUSCON ADJUSTABLE INSERTS



TRUSCON TAPPED INSERTS

Truscon Pressed Steel Inserts are placed in the correct, desired position BEFORE the concrete is poured. Saves time, labor, money. Assures correct placement of fixtures and easy, quick changes.

WRITE FOR ILLUSTRATED LITERATURE!

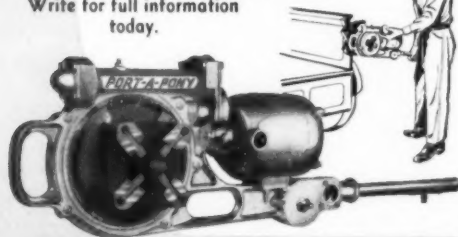


## TRUSCON STEEL COMPANY

6216 Truscon Ave., Cleveland 4, Ohio • Subsidiary of Republic Steel Corporation

## Port-A-Pony featherweight Portable PIPE THREADER

Truly a feather weight, the Port-A-Pony weighs only 26 pounds and is ideal for threading conduit and pipe in the shop or field. Use the Port-A-Pony to thread any 1/4" to 4" pipe in place. The 1/2 h.p. reversible motor operates on 110 volts AC or DC. Heavy duty case hardened gears are mounted in a rugged magnesium alloy casing. Adaptable to your die stocks. Write for full information today.



THREAD-EZY MFG. CO.

CORUNNA MICHIGAN



**R. STAFFORD EDWARDS**, (left) president of Edwards Company, Inc., Norwalk, Conn., shows H. F. Jones, of duPont de Nemours, latest Edwards' fire alarm station at luncheon celebrating the 80th anniversary of Edwards Company in Hotel Baltimore, New York, on April 28. The observance stressed good relations between big and small business in the United States.

some of whom it was their first convention. Because of Chicago's central location quite a number were from Chicago's trading area.

Some 80 entries were made in the Award Contest this year. The committee consisted of Tom Russell, M. M. Argo and C. W. Hiers.

As soon as practical, these entries and other interesting ones will be prepared for distribution to the membership.

• • • • •

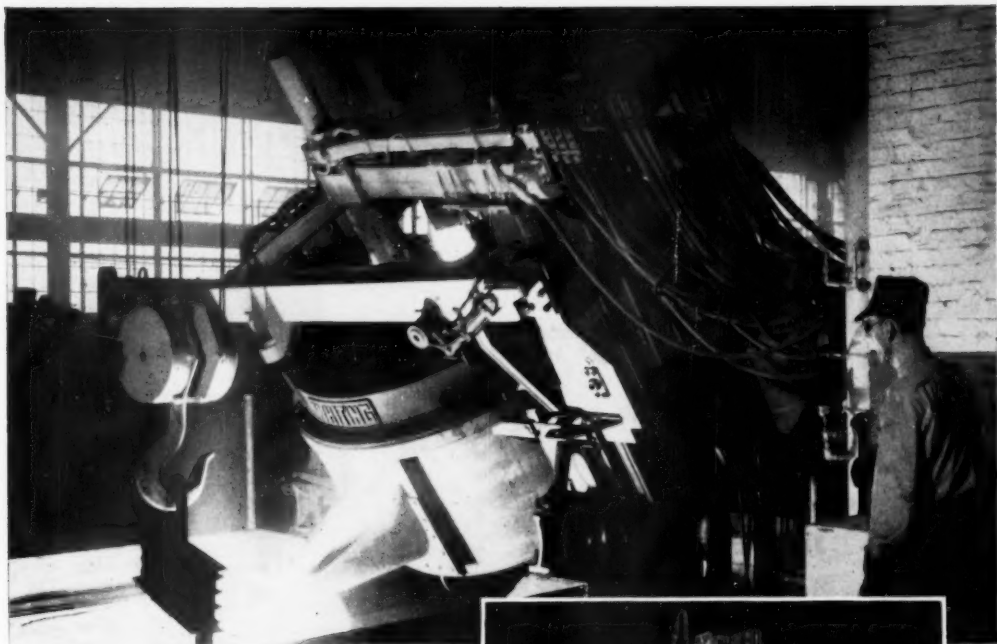
The meeting of the New England Chapter was held at The Hotel Bradford on April 3. President Bert L. Whittenmore presided.

Since this was the annual meeting and there was considerable business to be transacted it was decided to first present the speaker of the evening. The president then called on the program chairman Harry Bedig who in turn called on Clinton Bowman of P. R. Mallory & Co. who gave a fine description of the history and use of condensers on motors. At the conclusion of his lecture there were many questions from the members.

The president then called on and heard reports from the following officers: treasurer, secretary, vice-president, president and chairman of the following committees: membership, by-laws, house, ticket, idea, Foremen's Meeting, and it was moved that these reports be all accepted and placed on file. It was voted that the report of the nominating committee, presented by David Sandman, be accepted.

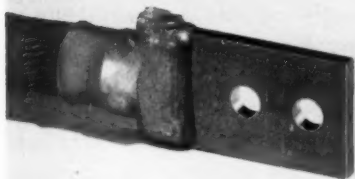
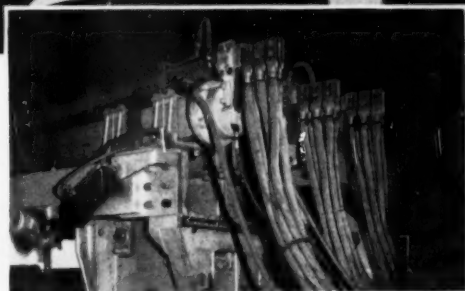
The following officers were elected for 1952: President—Harry G. Bedig; Vice President—Edwin E. Kolhonen; Secretary—Daniel MacDonald; and Treasurer—Arthur Clines.

Immediately after the conclusion of



# Whiting Corporation

Connects with  
**CADWELD**



1750 MCM cored cable CADWELDED  
to 1/2" x 3" x 8" lug.

WHITING CORPORATION of Harvey, Illinois, pioneers in foundry equipment since 1884, has recently adopted CADWELD lug connections for the leads on their "Hydro-Arc" electric arc furnaces.

#### LUGS OF COPPER BAR STOCK

- have 100% relative conductivity.
- eliminate expensive tooling.

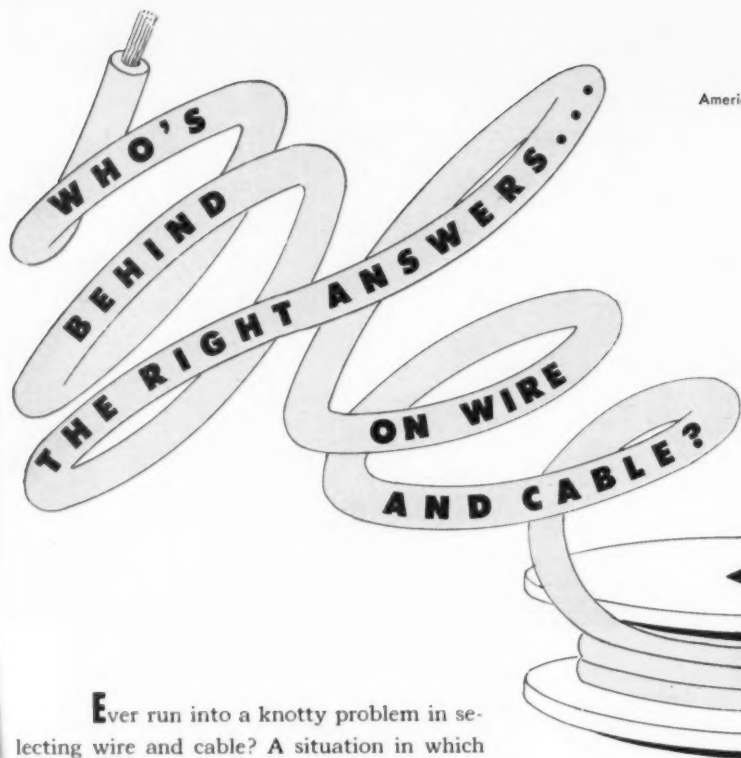
#### THE CADWELD CONNECTION

- cannot loosen or corrode.
- cannot be damaged by excessive overload.
- has a current carrying capacity equal to that of the cable.



Solve your lug problem  
**TODAY—**  
 **CATALOG  
ON  
REQUEST**

**ERICO PRODUCTS, INC.**  
2070 EAST 61 PLACE • CLEVELAND 3, OHIO



**WIRE AND CABLE ADVERTISING  
IN THE MAY ISSUE OF  
ELECTRICAL WHOLESALING**

American Steel & Wire, Div. U. S. Steel Co.  
Anaconda Wire & Cable Co.  
Columbia Cable & Elec. Corp.  
Cornish Wire Co.  
Crescent Ins. Wire & Cable Co.  
Hazard Ins. Wire Works Div.  
Okonite Co., The  
Paranite Wire & Cable Div.  
Roebling's Sons Co., John A.  
Rome Cable Corp.  
Triangle Conduit & Cable Co., Inc.  
United States Rubber Co.  
Western Insulated Wire Co.

**E**ver run into a knotty problem in selecting wire and cable? A situation in which anyone of several types would have done the job OK . . . but there was only one right type. So you grabbed the 'phone and called your wholesaler's salesman. He set you straight in a matter of moments. And after talking with him you went confidently about your work.

It's reassuring to have a man you can rely upon in a pinch. And just as you turn to your wholesaler's salesman for reliable information, he turns to manufacturers of wire and cable for background material so essential to providing the *right answers*.

Above are the manufacturers of wire and cable who advertised in the May issue of **ELECTRICAL WHOLESALING**. Through advertising they are able to set-up a direct line with your wholesaler's salesman. They give him useful facts on different types of insulation, new applications, performance characteristics, availability and a host of other pointers that enable him to advise you more intelligently . . . and assist you in conducting a more efficient and profitable operation.

ALERT ELECTRICAL WHOLESALERS AND THEIR SALESMEN READ

A McGraw-Hill Publication  
330 West 42nd Street  
New York 36, N. Y.

**ELECTRICAL  
WHOLESALING**

THE NATIONAL MAGAZINE OF ELECTRICAL WHOLESALE DISTRIBUTION



**C. P. WILSON**, J. J. Koepsell Co.; J. J. Conrad, Hasche Electric Co. (contractor); and Harold Sternard, chief electrician, Plastics Engineering Co.—all of Sheboygan, Wis., examine conduit fittings and wiring accessories, at Milwaukee's E.M.E. industrial electrical exposition.

the election the retiring president Bert L. Whittemore then presented the gavel to the incoming president Harry G. Bedig and he assumed the president's station. The new president then called on Jack Reddington who presented to the retiring president Bert L. Whittemore a very handsome traveling bag and complimented him on his fine year of outstanding service. Retiring president Bert L. Whittemore responded with a few well chosen remarks and expressed his great enthusiasm for the NISA.

The South Carolina State meeting was held in Columbia, South Carolina on March 7 and 8 with dinner and entertainment on Saturday night at the Columbia Country Club. About 30 men and their wives attended and enjoyed this affair. On Sunday morning the men had a very interesting and informative round table discussion which was beneficial to all present.

The Los Angeles Chapter held their regular meeting April 8 at the Rodger Young Auditorium. Meeting was called to order by Chairman Wm. Hogue. Introductions were in order and each one in attendance was called upon to introduce himself and mention the firm he was with.

Chairman Hogue called on William Hill of the Hill Electric Co. for a short talk on Apprenticeship Training for the motor repair shop. He was followed by the Sec'y-Treas. Earl Sweinhart, who spoke on the following: (1) Membership increase, (2) June meeting and (3) Membership decals.

William Hogue spoke briefly on the questionnaire sent by the Home Office,



## This HYDRAULIC Knock-out Punch Driver is 60% faster!

Drive knock-out punches with an amazingly low-cost "Porto-Power" hydraulic jack! A few easy strokes on the pump does it! Compare that with the old-fashioned method of a half-hundred knuckle-busting turns on a wrench. With "Porto-Power," you save on every hole punched — workmen are happier, safer — dies last 6 times longer — speed is spectacular! Pays for itself on the first good job!



### A LOW-COST KIT FOR EVERY RANGE —

Blackhawk Knock-Out Punches and the hydraulic rams are available in complete kits serving  $\frac{1}{2}$ " up to 2" and  $\frac{1}{2}$ " up to  $4\frac{1}{2}$ " openings. Attention, owners of wrench-operated punches: You can buy hydraulic equipment separately.

## And big extra uses for hydraulic Porto-Power

Blackhawk electrician's equipment features famous "Porto-Power" hydraulic units. Unlike ordinary jack units, pump and ram are separated by a flexible hose. Ram is all-directional — much handier for hole



punching, pipe bending and allied jobs. Low-cost Blackhawk Benders . . . today's No. 1 line — handle both rigid and thin-wall conduit better, faster.



### CLIP COUPON

for two helpful bulletins, 50-B and P-50. Buy from leading supply houses.

**BLACKHAWK**  
HYDRAULIC Porto-Power EQUIPMENT

### BLACKHAWK MFG. CO.

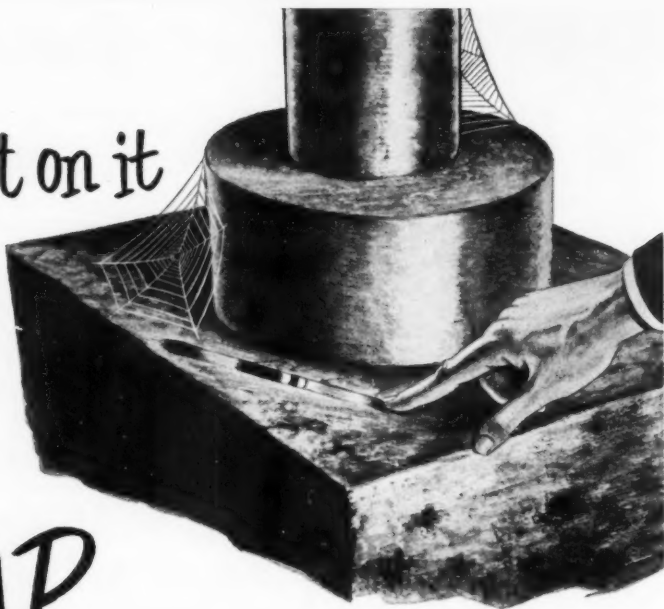
Dept. P-2062, Milwaukee 1, Wis.  
Please send me immediately your free Catalogs 50B and P-50 covering the full line of Blackhawk Electrician's Equipment.

Name \_\_\_\_\_  
Firm \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zn \_\_\_\_\_ State \_\_\_\_\_



If there's dust on it  
it may be  
precious scrap!

If it's  
SCRAP



it's needed to make **STEEL!**

One half of all the raw materials used in steel production is *scrap*. Today, the mills aren't getting enough iron and steel scrap to keep up with greatly increased steel production.

#### AND WHAT IS SCRAP?

Scrap is many things. Here are three:

1. the "left-overs" of iron and steel production, fabrication and machining.
2. junked autos and old farm machinery.
3. obsolete iron and steel equipment in factories, such as old machinery, tools, dies, jigs, fixtures, chain, valves, etc.

But—the "left-overs" are not great enough today to fill the unprecedented demands for steel production.

And, with replacements scarce, less junked autos and farm machinery have entered the scrap supply lines.

So—only by digging out all the never-to-be-used odds and ends of broken, worn-out, and obsolete factory equipment . . . can mills and foundries get all the scrap they need.

If they don't get it, steel production rates may be severely hampered . . . and our country's effort to maintain military strength and civilian economy at the same time, will be crippled.

#### It's YOUR Job to Furnish More Scrap

Institute a steel scrap salvage program in your plant. Appoint one top official in your company to take full responsibility. Have him consult with your local Scrap Mobilization Committee and local scrap dealers. The nearest office of the National Production Authority, Department of Commerce, can tell you who your local Scrap Mobilization chairman is.

Do this now. Write for a copy of the booklet, "Top Management: Your Program for Emergency Scrap Recovery", to Advertising Council, 25 W. 45 St., New York 19, N. Y.

SCRAPPY SAYS:

**AID DEFENSE**  
**MORE SCRAP**  
**TODAY...**  
**MORE STEEL**  
**TOMORROW**



NON-FERROUS SCRAP  
NEEDED, TOO!



*This advertisement is a contribution, in the national interest, by*

**McGRAW-HILL PUBLISHING COMPANY, INC.**

330 WEST 42nd STREET, NEW YORK 36, N. Y.



**CONTRACTORS' MEN** about cable connectors at E.M.E. Show in Milwaukee: (L to R) Robert Driver and A. Slaassted, Industrial Elec. Constr. Co., Racine, Wis.; Robert Daneke, Magaw Electric Co., Milwaukee; R. S. Cottingham, Burndy representative; and E. Sondergaard, Industrial Elec. Constr. Co., Racine.

on industry controls, urging all members to fill out and mail promptly. The highlight of the evening was the speaker of the evening A. H. Gудie of the Biddle Trade Bureau who spoke on pricing, coverage, results of their service to the electrical industry and how it fits in with the Office of Price Stabilization. Discussion followed.

The Quaker City Chapter of Philadelphia, Pa. held its meeting on April 9 at Beck's on the Boulevard Restaurant. President Jos. Wagner presided. Roll call showed 36 present. Minutes of preceding meeting was read by secretary and approved as read. Report of financial condition of Chapter read by treasurer and approved as read. Entertainment committee reported that the June social meeting of the chapter would be held at LuLu Temple Country Club on Friday evening, June 27th. This met with unanimous approval of the members present.

Mr. Hearsamm of General Electric Co. presented an interesting talk on current models of industrial motors, with particular reference to explosion-proof types.

During the last meeting of the Metropolitan New York Chapter arrangements were made for the first Foremen's Meeting of the Chapter to be held on June 7 in New Jersey. A very interesting program is being prepared and it promises to be an outstanding affair of the year. The following members were assigned to handle different points of the program: Hillrie Griffith, Meyer Friedkin, Carl Christiansen, George R. Lockwood, Herbert Engelmann, Stanley Bojak, Walter Leirer.

## Quality



# GEM

## Guaranteed

*Your Assurance of BEST QUALITY for SAFE USE*

**CORD HOLE**  
13/32 - .406

**15 AMP. 125 V.**  
**10 AMP. 250 V.**

No. 738



No. 739



No. 740



No. 737



No. 741



No. 742



No. 743



No. 735



No. 741



No. 742



No. 743



No. 736



**PENNANT TEAM 9 CHAMPION RUBBER CAPS AND CONNECTORS. EACH A HIT. GEM QUALITY SECOND TO NONE YET LOWER IN PRICE THAN ANY THAT ARE COMPARABLE.**

**ON THE BENCH WE HAVE MAJOR PLUG AND CARTRIDGE FUSES, FUSSTATS, BLUE LABEL CORD SETS, EXTENSIONS AND A COMPLETE ARRAY OF WIRING DEVICES, SPECIALTIES, GENERAL ELECTRIC XMAS LAMPS, SETS AND DECORATIONS.**

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**GEM ELECTRIC MFG. CO., INC.**  
BUSH TERMINAL BUILDING  
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## TO THREAD PIPE ON THIS MACHINE




**"Look! I'm threading pipe with an oil can!"**

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Range of the machine: 1/4" to 2". Range with drive shaft: 2 1/4" to 8".

*Be wise...MOTORIZE your stocks and dies!*

**THE OSTER MFG. CO.** 2081 East 61st St., Cleveland 3, Ohio, U.S.A.

☐ Rush copy of catalog bulletin on No. 422 POWER VISE STAND.

☐ Rush names of Oster Distributors in our area.

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ADDRESS \_\_\_\_\_



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*Especially Calibrated . . .  
Indispensable for*

- CONTRACTORS
- ARCHITECTS
- ENGINEERS

No calculations—no chance for error—measures curved and irregular lines and will totalize number of straight lines. Run roller over line from right to left and read exact measurement from dial. Press stem to re-set to zero. You can't afford to be without it! Finest Swiss precision instrument. Guaranteed. Literature available.

#1860—graduated in inches and tenths  
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Order direct or through your dealer.

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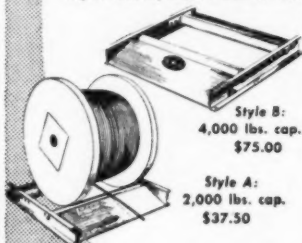
## Reels Just Go Rollin' Along To Job Or Storage

Why push, shove, pull or rely on jacks  
when the most efficient way is to use

## ROLL-A-REEL

It's husky, long-lived, easily carried to reels, job or storage. The low slanted front and positive front lock insure quick loading or unloading.

Remove wire, cable or rope from top or bottom, front or back of reel.



Style B:  
4,000 lbs. cap.  
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**\$37.50**

• PROMPT DELIVERY: ORDER NOW!

## ROLL-A-REEL

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Albert Bonahur, Milton G. Volcker and J. P. Ryan.

At this meeting newly elected officers were initiated to their offices and the past president was presented with field glasses in appreciation of his two year term of service to the chapter.

Main speaker was R. Wells formerly on the staff of New York University. He talked on "Cost and Cost Control". The subject was presented in a very informative and powerful manner and was appreciated by all.

From Walter J. Price, The Maintenance Co. Inc., New York City.

## Book Reviews

### Techniques of Plant Maintenance

A most comprehensive compilation of maintenance materials, methods and management procedure is found in "Techniques of Plant Maintenance", the complete proceedings of the technical sessions held concurrently with the Second Plant Maintenance Show last January in Cleveland. The volume comprises not only the text of the 40 papers presented, but the discussion which followed each session, and the answers to the many questions which were submitted by those in session but which were not answered at the time of the sessions due to time limitations. The material, compiled by outstanding leaders in the field of maintenance, includes data on electrical, lighting, power plant and heating-equipment, paper and paper products, metal-working routines, recommended practices in chemical, food-processing and small industrial plants, lubrication information and a wealth of general material pertaining to inspection procedures, reports and records, training maintenance personnel, costs, planning and scheduling maintenance operations, painting and decorating.

The material includes drawings, charts and tables to clearly illustrate the text. The volume contains 223 pages, size 8 1/2 by 11 inches. It is bound in maroon fabricoid, with gold lettering. Priced at \$6.00, it can be secured from the publishers, Clapp & Poliak, Inc., 341 Madison Avenue, New York 17, N. Y.

### Electrical Reference

A practical and useful addition to technical libraries is the second edition of E. S. Lincoln's Electrical Reference. The book covers all aspects of electrical equipment, such as description,

## WHY GET UPSET WHEN MOTORS BREAK DOWN?

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**C. STODOLA** and George Canham, Wisconsin Electric Power Co., check cable connector tools with Bill Risberg and John Smithson representing Thomas & Betts Company, at the E.M.E. Show in Milwaukee.

ratings, operating principles and functions. It also includes considerable information referring to installation techniques and methods. Data has been carefully revised and expanded to include the latest information on equipment and uses. The information is clearly presented, using text, charts and tables, photographs and diagrams, and it also tells the reader how to operate the equipment, how to maintain it, and where to obtain it.

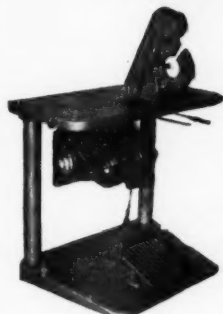
The book is divided into 26 sections, covering fundamentals, industrial wiring, switchgear and substations, panelboards, controls and protective equipment, motors and generators, capacitors, lamps and lighting methods, electric heating, furnaces and welding, signal and communication systems, transformers, batteries, electronic equipment, measurements and instruments, surveys, maintenance, mechanical drives and insulations.

At the rear of the book are cumulative, table, NEMA and National Electrical Code Indexes for rapid reference. Since the entire 1951 Code has been included, inserted in the various chapters to which sections apply, the reader can refer simultaneously to rulings, methods, equipment and installation data. This same method of treatment has been used in connection with NEMA Standards.

The Reference should be of use to plant electrical engineers, maintenance men, contractors, consultants and designers.

Published by the Electrical Modernization Bureau, Inc., 110 Mamaroneck Ave., White Plains, N. Y., the book includes 1744 pages measuring 8½ by 11 inches and presents 600 tables and nearly 2000 diagrams and illustrations. The price is \$25.00.

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**POTTER & RAYFIELD, INC.**  
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CRAFTSMANSHIP  
P. O. BOX 1042  
ATLANTA, GA.

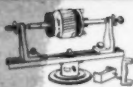
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motor repair shop equipment

**TIME-SAVERS TO CUT COSTS  
ON MOTOR REPAIR JOBS**



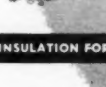
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Shorten the time it takes to put a motor through the repair shop and you reduce costs or increase your profit margin on every job! Let CROWN Motor Repair Shop Equipment help you do it! Expressly designed by practical electrical men to increase shop volume and quality without increasing payroll. Every item in the CROWN Line has proved in actual shop practice to pay for itself many times over. Engineered to highest standards and economical in first cost.

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Please send me your new catalog of motor repair shop equipment.

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CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

—for men who plan electrical installations and specify electrical materials and equipment...

## THE MASTER ELECTRICAL SPECIFICATIONS ISSUE is coming in JULY

A revised and expanded reference book of up-to-the-minute specification paragraphs covering every phase of interior electrical work—lighting, wiring, power applications, motors and controls, signalling and communications, and electric heating

"INDUSTRIAL CONSTRUCTION CONTINUES STRONG" . . .  
"COMMERCIAL CONSTRUCTION BUILDS IMPRESSIVE BACKLOGS" . . .  
"SCHOOL CONSTRUCTION NEEDS GREAT" . . .  
"RESIDENTIAL CONSTRUCTION RATE STEADY" . . . but what percentage of the total construction dollars can the electrical construction industry reap?

The answer to this all important question will be determined, to a very great extent, by electrical specifications. If electrical specifications are carefully written and detailed, electrical construction people can sell and prove the benefits of adequate electrical jobs . . . raise the level of electrical work . . . and obtain a larger share of today's big construction dollars.

The Master Electrical Specifications Issue will establish a new standard for exact wording in writing electrical specifications and for checking their completeness . . . in accordance with the most advanced practices. It will provide electrical contractors, heads of industrial electrical departments, consulting engineers and architects with an accepted, authoritative reference for planning electrical installations.

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1. Each section will be written as specification paragraphs. This means that you can prepare your own specifications by copying directly from this master reference.
2. It will enable you to check on the completeness of specifications prepared by others so that you can present recommendations for changes or additions to sell superior methods or materials.
3. To aid you in your selection of products when writing electrical specifications, all products advertised in sufficient detail to be of real assistance—will be listed in a special product index under general product headings.

Remember! The master Electrical Specifications Issue is coming in July. It hasn't been published since 1949. It won't be published again until 1955.

## ELECTRICAL CONSTRUCTION AND MAINTENANCE

A McGraw-Hill Publication

330 West 42nd Street New York 36, N. Y.

## Electro Mfg. Merges With Bright Light

Two prominent fixture manufacturers have combined to form the new Electro Silv-A-King Corporation. The new corporation represents a merger of all operations of the former Electro Mfg. Corp. and the Bright Light Reflector Company, manufacturers of fluorescent and incandescent lighting equipment.

According to Charles I. Schneider, president of the new Electro Silv-A-King Corp., the present factories and warehousing facilities of both of the merging companies will continue in full operation. The sales staffs of Electro Mfg. and Bright Light Reflector will be combined under the direction of Mr. Schneider.

Executive offices and factories of Electro Silv-A-King will be located at Chicago, Ill. and Bridgeport, Conn. Officers and directors of the corporation are: L. K. Schoenbrod, W. Litner, W. D. Cahill, P. Litner, C. I. Schneider and L. Litner.

## Among the Manufacturers

### Headquarters Announcements

Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.—O. B. Wilson, field sales manager for the Industrial Division, Brown Instruments division.

General Electric Company, Schenectady, N. Y.—Richard A. Gehr, sales manager of the Industrial Heating Department, heaters and devices.

The Electric Products Company, Cleveland, Ohio.—Gordon J. Berry, president.

Westinghouse Electric Corp., Pittsburgh, Pa.—W. W. Sproul, vice president in charge of the general industrial products group of divisions, Micarta, Standard Control, Small Motor, Elevator, Sturtevant, Welding and Lighting divisions and the Bryant Electric Company; L. B. McCully, vice president in charge of the East Pittsburgh divisions, Transportation and Generator, and Switchgear; H. E. Seim, vice president in charge of the Sturtevant division, Boston, Mass., and the Bryant Electric Company.

Air Reduction Company, Inc., New York, N. Y.—George V. Slottman, vice president.

Minnesota Mining & Manufacturing Co., St. Paul, Minn.—Alan H. Redpath, merchandising manager of all tape products; Dr. Charles W. Walton,



**Plenty of Slip—**

**Y-ER EAS**

Wire Pulling Lubricant



**For Lead, Rubber, Braid or Synthetic Covered Cables**

Nothing else gives "slip" to electric cables like Y-Er Eas. This creamy non-corrosive lubricant simplifies cable pulling, especially through saddles and sharp turns.

Y-Er Eas is never harmful to cables or conduit. It performs the slipping function, then dries out and shrinks in volume leaving only a light film of powder.

**ONLY Y-ER EAS HAS ALL THESE FEATURES!**

Write for Descriptive Folder



- Never messy or greasy to use.
- Never harmful to hands or clothing.
- Prevents sticking and setting of cables.
- Does not run back on cables.
- Facilitates removal of cable at later date.

Improved Y-Er Eas has been tested and approved by the Underwriter's Laboratories, Inc.

At all leading Electrical Supply Houses



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**MINERALLAC**

Perforated

**STRAP**

Versatile Hanger Iron



Safely supports hanging pipes, conduits and cables up to 500 lbs. Made of 1/4-in. 18 gauge electro-galvanized steel (also available in Everdur, copper, brass or aluminum). Precision made — perforations do not vary. 1/4-in. holes on 1/2-in. centers. Comes in 10-ft. coils and 5 and 10-ft. straight lengths. Available in other lengths also.

Send for literature and prices

Specify **MINERALLAC**  
HANGERS, CLIPS,  
STRAPS, BUSHINGS

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23 North Peoria Street  
Chicago 7, Illinois

**MINERALLAC**

general manager of the adhesives and coatings division.

Browning Laboratories Inc., Winchester, Mass.—Freeman A. Spindell, vice president.

Dodge Manufacturing Corp., Mishawaka, Ind.—Fred J. Ebeling, general sales manager.

Westinghouse Electric Corp., Pittsburgh, Pa.—James R. Weaver, assistant to the vice president in charge of manufacturing.

General Electric Company, Bridgeport, Conn.—James J. Slattery, vice president and general sales manager of General Electric Appliances, Inc.

## Regional Appointments

### NEW ENGLAND

Sola Electric Company: John B. O'Donnell, Boston, Mass., sales representative.

### MIDDLE ATLANTIC

Minneapolis-Honeywell Regulator Co.: John A. Robinson, sales manager of the eastern and mid-Atlantic regions for the Industrial Division.

The Black & Decker Mfg. Co.: E. M. Stuart, district sales manager for the Northeastern region.

Sylvania Electric Products Inc.: J. F. Davis, sales manager for the Newark, N. J., district; E. B. Colby, sales manager for the Pittsburgh, Pa., district.

Unistrut Products Company: Cornelius Elsasser, Jr., Irvington, N. J., eastern district manager.

Apex Electrical Mfg. Co.: Charles W. McNinney, Philadelphia, Pa., district manager.

Gould-National Batteries, Inc.: F. A. Miller, co-ordinator of sales at Trenton, N. J., headquarters; Frank Keenan, manager of the headquarters sales staff; Malcolm Janis, regional manager at New York, N. Y.; O. W. Rider, regional manager at Pittsburgh, Pa.

### SOUTH ATLANTIC

Bulldog Electric Products Company: Walker Electrical Company, Atlanta, Georgia, representative in the South.

The Black & Decker Mfg. Co.: A. Lee Proctor, district sales manager for the Southeastern region.

Sterling Electric Motors, Inc.: E. Stephen Farlow, manager of the new Baltimore, Md., sales office.

### EAST CENTRAL

Hyster Company: Robert F. Moody, Peoria, Ill., industrial truck sales manager for the eastern division.

Sylvania Electric Products Inc.: Robert V. Smith, National Accounts

## NEW LABELING TAPE

Write on it—Won't Smudge  
resists dirt, oil, water, acids



## For Shop, Factory, Laboratory

Nothing else like LABELON—the amazing "Write on it" plastic tape! Use it to identify fuel lines, electrical circuits, panelboards, instruments . . . to label laboratory equipment, supplies, experiments, models . . . to indicate repairs and service . . . to tag tools, mark bins . . . to label office files, folders, storage cartons, etc.

LABELON TAPE sticks without moistening to any smooth, clean surface—yet can be quickly removed. Resists heat up to 160°. Just write on it with pencil or stylus — message won't smudge. Choice of widths and colors. Handy dispenser with cutter bar.

See your nearest dealer,  
or write for sample and prices.

**LABELON TAPE CO., Inc.**

Dept. EC, 450 Atlantic Ave., Rochester 9, N. Y.



**JACKSON**

Porcelain Enamelled

**YARDLIGHTS**

"Won't Blow Down" . . . with JACKSON you install a "life-time" Yardlight. Modern design, one-piece heavy gauge steel finished with three coats of Vitreous Porcelain Enamel—completely wired and assembled. Withstands wind and weather. Listed by U. L.—approved for R. E. A. installations. Send for catalog.

- Manufacturers of Reflectors, Yardlights, Vapor-proof Units, Weather-proof Sockets
- Sold only thru Distributors

Small Adjustable  
**FLOODLIGHT**

Residential - Commercial - Industrial for permanent or temporary installations. Heavy gauge steel construction, baked enamel finish — 7 1/2" and 10 1/2" dia. ref. — durable, tough, weatherproof. Universal adjustment—install on any flat surface or attach directly to 3/4" or 4" outlet box. Approved for cord and plug.



7107-7110

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**ELECTRICAL COMPANY**

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## Your future may be in electronics

With electronic devices coming more and more to the fore in industry and the home, the career possibilities in the electronics field get bigger and bigger every day. Make sure that you're going to get your share of the advancement and money that go to the man who really understands and can work with these devices. Here is a book that gives you the basic facts on the atom, the electron, and radiant energy, in a simple and clear manner.



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## PRIMER OF ELECTRONICS AND RADIANT ENERGY

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isotopes  
molecules  
energy  
light  
infrared  
rays  
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rays  
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Gives a clear picture of the general principles underlying electronics, and of how radiant energy is produced and controlled. Explains what electricity is, and tells how its energy is used. Tells what magnetism is, and describes generators, transformers, and harmonics. Describes electromagnetic radiation in detail, and shows how it is put to work in various important electronic devices in use today. Also discusses electron tubes and the sources of radiant energy.

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This offer applies to U. S. only

Sales, Chicago, Ill., representative for the lighting division.

Minneapolis-Honeywell Regulator Co.: Joseph J. Matulis, industrial manager for the midwest region; C. G. Behnke, industrial manager of the Chicago, Ill., branch office.

Gould-National Batteries, Inc.: John P. Kelly, regional manager at Detroit, Mich.

The Black & Decker Mfg. Co.: Raymond G. Horner, district sales manager for the Central region.

Steber Manufacturing Company: B. H. Etsinger and W. M. Snyder, sales representatives in the greater Chicago, Ill., area.

### WEST CENTRAL

Rome Cable Corp.: R. R. Davis, Kansas City, Mo., branch sales manager.

General Electric Company: Theodore C. Lauck, manager of the Delta sales district, New Orleans, La., of the lamp division.

The Black & Decker Mfg. Co.: Wm. L. Poynter, district sales manager for the Midwest region.

Mitchell Manufacturing Co.: Harry Walker, Kansas City, Mo., sales representative for the Greater Kansas City territory.

Reliance Electric & Eng. Co.: Harold A. Ploch, Houston, Texas, sales application engineer, Southwestern district sales office.

General Electric Company: Ralph A. Nungesser, Dallas, Texas, manager of the Southwestern sales district of the lamp division; H. E. Lindberg, manager of the Dallas, Texas, service district of the lamp division.

### WEST

The Electric Products Company: Robert A. Young & Co., Glendale, Calif., sales and service representatives for Southern California and Arizona.

Westinghouse Electric Corp.: David C. Fulton, San Francisco, Calif., Pacific Coast machinery electrification manager.

The Black & Decker Mfg. Co.: Arthur S. Boehm, district sales manager for the Pacific Coast region.

Gould-National Batteries, Inc.: Stanley J. Mahurin, regional manager at San Francisco, Calif.

Titeflex, Inc.: William Buckley, Los Angeles, Calif., West Coast sales representative.

### CANADA

General Controls Company: George Crothers, manager of the Toronto branch office.

The Black & Decker Mfg. Co.: Donald S. McKeracher, district sales manager for Canada.

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**Equipment, Materials,  
Supplies and Services for  
Electrical Construction—  
Maintenance—Repairs**

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A power tool of many uses for electrical contractors and plant maintenance work. Hammer is detachable from drill member. Drills concrete 3/4" to 1 1/2" diameter, metal to 3/8" and wood to 3/4". Forged hammer tools for chipping, channeling and cutting masonry materials. Attachment for right angle drilling.

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### LINDELL BORING ATTACHMENT

Fast, easy boring  
Drill attachment for  
easy boring in hard  
to reach places, overhead  
or below without ad-  
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Fits any 1/2" drill.  
Reduced speed for more  
power.

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### STOP that WATER

with FORMULA NO. 640, a clear liquid which penetrates 1" plus in concrete, brick, stucco, plaster, etc. Seals out water, dirt. Holds 20' head. Use outside and in. Preserves all absorbent materials. Sold 14 years. Quick, economical, sure. \$3 in 55's. Free sample. See Sweet's. HAYNES PRODUCTS CO., OMAHA 3, NEBR.

## A Good Habit

The Where-to-Buy Section of Electrical Construction and Maintenance supplements other advertising in this issue with these additional announcements of products and materials of special interest and application in the field of electrical construction, maintenance and repair work. Make a habit of checking this page each issue—a good habit!

## CHECK LIST CARDS BOOST SHOP EFFICIENCY

(FROM PAGE 71)

(to customer name) in a rack at the superintendent's desk. It stays there until the job is completed. Such filing facilitates replies to customers' inquiries as to status of work in process.

The heavy buff card (Card 2) stays with the motor. The mechanic who makes the initial check and test lists all the repairs to be made. This information is immediately checked by the shop foreman or superintendent. As the motor goes through the repair line, mechanics indicate quantities of materials used on the card list. Mechanics are constantly cautioned against slip-ups by this slogan printed across the top of the list: "Materials Not Charged Mean a Loss to All of Us."

When the repair job has been completed and shipped, the job cards are reviewed by the supervisors. Material items are extended for costing and various data completed for billing information. Then they go to the office costing department. Scherer Electric uses a job envelope system. Each job has an envelope in which all pertinent information is filed, including the job cards after billing has been completed. Job envelopes are kept for a period of about 20 years.

Does this check list card system increase the efficiency of a shop operation? The answer of Scherer management is an unqualified "Yes." As B. A. Hannewald, vice president and general manager, says, "We feel that our printed forms are necessary to give us the records we want. Maybe some other way would meet the need, but you would have to do a selling job to convince us."



**FROM THE FLOOR** at NISA convention forum, G. H. Bedford, Ainsworth Electric Co., Ltd., Toronto, Canada, relates his experience with 25-cycle transformers.

# SEARCHLIGHT SECTION

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BUSINESS:

"OPPORTUNITIES"

EQUIPMENT  
USED OR RESALE

### UNDISPLAYED

\$1.75 per line, minimum 8 lines. To secure advance payment count 8 average words as a line. Position Wanted and Individual Selling Opportunities undisplayed rate is one-half of above rate, payable in advance.

Two Numbers in care of our New York, Chicago & San Francisco offices count as one additional line. Discount of 10% if full payment is made in advance for 4 consecutive insertions.

New Advertisements: Address N. Y. Office, 330 W. 42nd St., N. Y. 36, N. Y., for July issue closing June 20th.

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### DISPLAYED

Equipment Wanted or For Sale Advertisements are available only in Displayed Style. Individual spaces with border rules for prominent display of advertisements.

The advertising rate is \$11.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An Advertising Inch is measured "in" vertically on one column, 3 columns—38 inches—on a page.

For July issue closing June 20th.

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We are responsible manufacturers, interested in making arrangements for adding to our line many new products for the distribution or utilization of electricity, either for building construction or power service.

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MOTORS-GENERATORS-TRANSFORMERS  
New and Guaranteed Rebuilt  
1 H.P. to 2500 H.P.  
ELECTRIC EQUIPMENT CO.  
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1—Westinghouse A.C. motor, 400 HP, 3 phase, 60 cycle, 2300 volt, full load speed 1762, frame 4-32-13 type CB, splashproof, serial #1813P748. Also starting equipment. Purchased new in 1940.

NEKOOSA-EDWARDS PAPER CO.  
Port Edwards, Wisconsin

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No lengths too long or too short

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PIERCE CABLE CO.

2664 Clybourn Ave. Chicago 14, Illinois

## "SEARCHLIGHT" IS

Opportunity Advertising

—to help you get what you want.  
—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want

"Think SEARCHLIGHT First"

## ELECTRICAL EQUIPMENT FOR SALE

3—Westinghouse C.S.P. transformers, subtractive polarity, 60 cycle, 25 K.V.A., single phase. Style SGO8787, Cont. 50° C Rise, Voltage 12000/240/480. Impedance 75% 2.1%.

1—Westinghouse Hydraul single phase transformer. Type Air = 10 KVA Continuous.

2800—1½" rigid wall conduit line.

2250—2" Rubber covered outside wire for pole line.

1—Batter Hammer Switches, 600 Volt capacity.

1—Metal junction box 20" x 20"

3—Overload circuit breakers for 480 Volts.

Reply to:

CLEMENS CONSTRUCTION COMPANY  
P. O. BOX 266 WEST NEW YORK, N. J.

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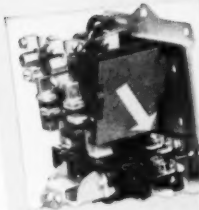
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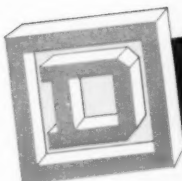


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